



**Citation:** Rosalina Montes Espín, Ileana Fernández Santana, Amanda Lucía, Vitloch Ramos, Leosveli Vasallo Rodríguez, Mario A. Lima Cruz, Javier Francisco-Ortega (2021) The expeditions of the research yacht Utowana and the building of the plant living collections of the oldest botanical garden of Cuba. *Webbia. Journal of Plant Taxonomy and Geography* 76(2): 143-166. doi: 10.36253/jopt-10929

**Received:** May 25, 2021

**Accepted:** July 15, 2021

**Published:** September 7, 2021

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**Data Availability Statement:** All relevant data are within the paper and its Supporting Information files.

**Competing Interests:** The Author(s) declare(s) no conflict of interest.

**Editor:** Riccardo M. Baldini

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## The expeditions of the research yacht Utowana and the building of the plant living collections of the oldest botanical garden of Cuba

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**Abstract.** Cienfuegos Botanical Garden is the oldest functioning botanical institution of Cuba. It was established originally as a joint endeavor between sugar magnate Edwin F. Atkins and Harvard University in 1901. Between 1925 and 1934, the research yacht Utowana performed ample plant germplasm collections for the USDA in the New and Old World as well as archeological and zoological surveys in the Neotropics. The botanical expeditions were conducted mostly, under the leadership of David Fairchild. In this contribution we review to what extent Utowana expeditions and collections were instrumental in building the living collections of Cienfuegos Botanical Garden. A total of 278 accessions (comprising 254 species) were introduced into this garden directly or indirectly through these expeditions. Currently 57 of these species (132 individuals) are still part of its living collections. Interestingly, five of the Caribbean expeditions of this research yacht carried plant material between the Cienfuegos Botanical Garden and two other botanic gardens that were operated by US entities, namely the Lancetilla Botanical Garden in Honduras (owned by the United Fruit Company) and the Summit Gardens in Panama City (managed by the Panama Canal governmental agency). Our study also shows that plant material collected during Utowana expeditions was sent from Old World and Caribbean Island botanic gardens to Cienfuegos Botanical Garden. Thomas Barbour, director of this botanical institution between 1927 and 1946 joined four of these plant hunting endeavors. He provided strong support for the growing of the Cienfuegos Botanical Garden living collections with plant material collected during Utowana expeditions.

**Keywords:** Greater Antilles, Allison Armour, David Fairchild, Thomas Barbour, Plant Exploration, Germplasm, Tropical Islands.

## INTRODUCTION

With 13 botanical gardens and 22 institutional herbaria, Cuba has the most extensive network of professional botanists of the Caribbean Islands (Thiers 2021; Hernández 2016: 64). Officially inaugurated in 1901, Cienfuegos Botanical Garden (CBG) is the oldest of these botanic gardens (Figures 1–2). Two other botanic gardens were established much earlier; however, they disappeared a few years after their founding. The oldest of these two gardens was originally created by the Spanish Crown in an area of Havana that was not far from the Capitolio (Capitol building). This particular garden was in operation between 1817 and 1839 when its land was sold to build a train station. A few plants from its living collections were moved to the Quinta de Los Molinos estate, also in Havana. Currently the Los Molinos site is considered as a historical garden, and it is run by the Ministerio de Cultura (Leiva 1995). The second early botanic garden was a private initiative led by José Blain (1808–1877), and it was located in the Pinar del Río province (Álvarez Conde 1958: 281–286). It had 175 ha and was known as El Retiro (González 2017). Blain was a naturalist without formal botany training who introduced into this site plants from all over the world. After his death, the garden was abandoned and decayed (González 2017).

Cienfuegos Botanical Garden was originally owned and run by Harvard University (see below), and it received ample support from United States of America sources until 1961 when this famous university suspended its operations in Cuba. Then the garden became a unit of the Academia de Ciencias de Cuba (Clement 1963: 565; 1964: 446).

David Fairchild (1869–1954, Figure 3), the founder of the plant genetic resources program of the United States Department of Agriculture [USDA; reviewed by Hodge and Erlanson (1956)] was one of the most enthusiastic supporters of CBG (Grey 1927: 10, 14; 1936). Fairchild himself conducted plant exploration expeditions that brought material to the USDA germplasm repositories from all over the world (Fairchild 1938a). Among these USDA expeditions, those on board the research yacht *Utowana* (years 1925–1933, Figure 4) explored many areas of Asia, Africa, Europe, and the Caribbean Basin (Fairchild 1930a, 1934a, 1938a: 472–475). It is worth indicating that not all of these expeditions had plant exploration as a primary objective. For instance, the last endeavor of this vessel (February 1 – April 20, 1934) targeted the Bahamas and Hispaniola but did not have any botanist on board and focused exclusively on archeology, herpetology, and ornithology.



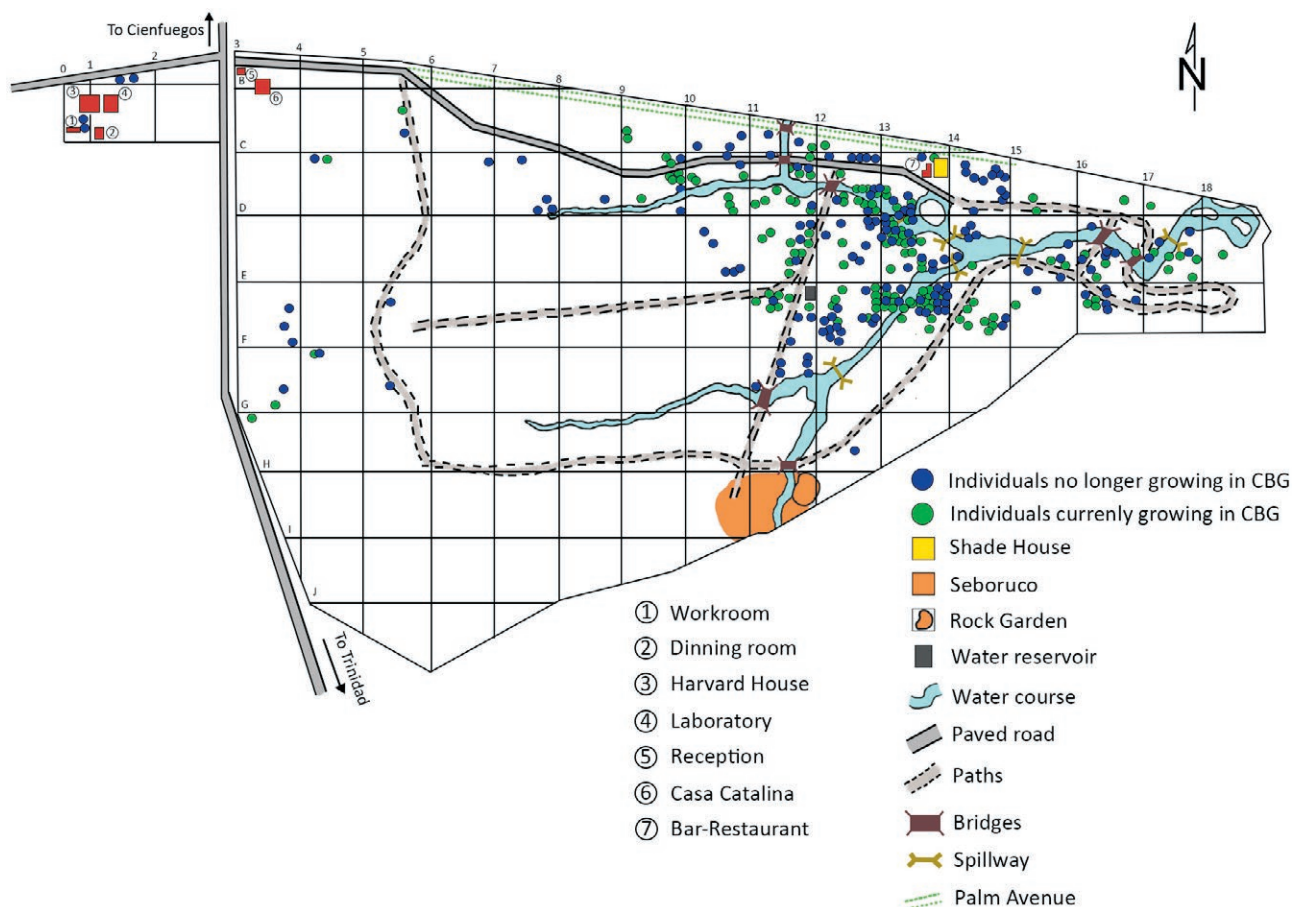
**Figure 1.** Geographical location of Cienfuegos Botanical Garden, Cuba.

In this contribution we present a historical study on the importance of the *Utowana* expeditions in establishing the living collections of the CBG. We will show how these expeditions were instrumental in: (1) bringing plant material directly from USDA stations to this botanic garden, (2) providing a wide array of tropical species from different regions of the world to be cultivated in Cuba, and (3) developing networks among botanic gardens of the Caribbean. The “*Utowana* plants” that are still growing in CBG represent a unique heritage for this island and are part of the living legacy of David Fairchild as a plant explorer and economic botanist.

#### *The archival and bibliographic research*

Our research is largely built on the study of documents (Figure 5), photos, letters, and plant records housed in the archives and library of CBG and of Fairchild Tropical Botanic Garden. A preliminary study on links between the *Utowana* trips and the history of CBG published by Vasallo Rodríguez (2017) provided initial perspectives to our study.

Two unpublished USDA reports pertinent to two of the *Utowana* expeditions that targeted the Caribbean Basin (1931 and 1931–1932) were also consulted. These



**Figure 2.** Current plan of Cienfuegos Botanical Garden showing its main facilities, alpha-numeric grid mapping system, and present/past location of individuals that reached this garden through Utowana expeditions.

two documents are housed in the US National Archives at College Park, Maryland (Armour 1931; Dorsett 1936). Robert M. Grey (see below) also produced an unpublished report on plants introduced in CBG between 1933–1935 (Grey ca. 1935, Figure 6). Among the published accounts, two reports (Figure 6) on the activities and collections of CBG were also relevant to our research as they list plant species growing in this garden in 1926 and 1933, respectively (Grey 1927; Grey and Hubbard 1933). Furthermore, CBG still keeps the original index-cards that were used to record the accessions that were introduced into this garden (Figure 7).

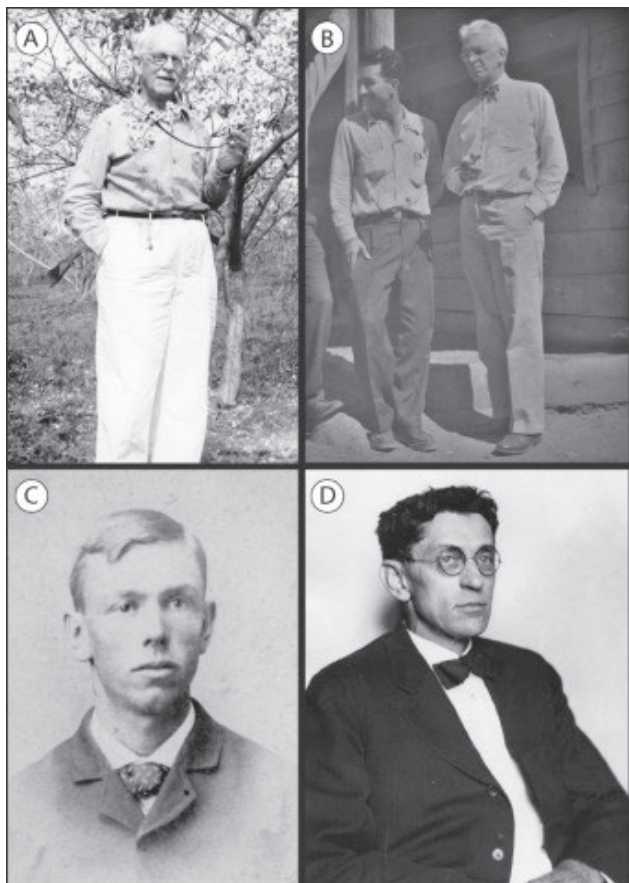
Determining the provenance of pre-1934 material cultivated in CBG was facilitated by information found in 19 issues of the USDA germplasm inventories that were published between the years 1923–1935. This was a regularly published journal entitled “United States Department of Agriculture. Inventory.”

Through these bibliographic and archival resources, we identified those plant species introduced in CBG that

were associated with Utowana expeditions (Online Supplementary Table 1). These species fell into three different categories: (1) material mailed directly from Asia or Africa during the Old World Utowana endeavors; (2) USDA germplasm accessions that the Utowana delivered to CBG during one of her five visits to Cienfuegos. This category mostly had samples that came from other Utowana expeditions, however, we also found a few non-Utowana accessions that are also included in this contribution; and (3) samples collected in the Caribbean Basin during one of the five Utowana expeditions that visited Cienfuegos. Most of these samples were delivered directly to the Garden once this vessel reached Cuba; however, we found that some of the samples were mailed to CBG from USA after the expedition was finished.

#### *Cienfuegos Botanical Garden: an historical overview*

A few scholarly publications have already discussed several aspects of the trajectory and importance of CBG



**Figure 3.** Relevant personalities in the history of Utowana expeditions and of Cienfuegos Botanical Garden. (A) David Fairchild. (B) Ángel Valiente (left) and Wilson Popenoe (right). (C) Palemon H. Dorsett. (D) Guy N. Collins. Courtesy of Archive and Library of Fairchild Tropical Botanic Garden (A, C), Library of Cienfuegos Botanical Garden (B), and Hunt Institute for Botanical Documentation (D).

(i.e., Grey 1927; Cahan 1991; Agüero and Ríos 1994; Howard 2000; Ojeda Quintana et al. 2007; Scott 2007; Fernández-Prieto 2018). As we read these works, some inconsistencies mostly regarding relevant historical dates were found. A critical review of the history of CBG is beyond the scope of this contribution, and therefore, here we provide only an overview of the main events that defined CBG. They are important for understanding the links that this garden had with David Fairchild and the USDA plant introduction program that he led. Our archival research showed that David Fairchild had extensive correspondence with most of the personalities who were directly involved in the developing of CBG. Many of them were pivotal for the introduction of plant material in CBG through the Utowana expeditions.

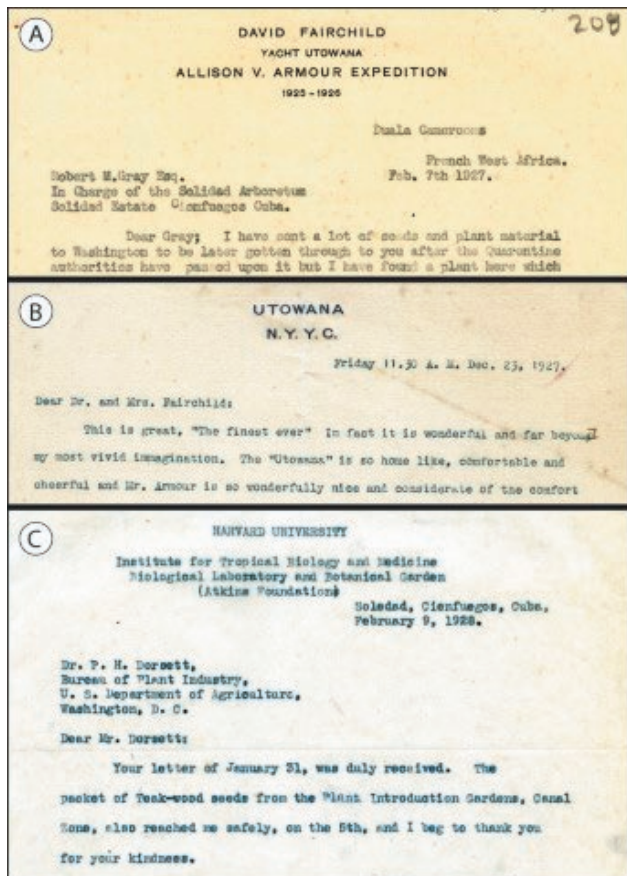
The origin of CBG stems from the inability of the



**Figure 4.** Research yacht Utowana in Puerto Colón, Panama, photo taken during the 1928 expedition of Palemon H. Dorsett to the Caribbean region. Courtesy of USDA National Agricultural Library Special Collections.

Sarría family to pay off their accumulated financial debts. In 1881, this resulted in US entrepreneur Edwin F. Atkins (1850–1926) and his partner Joaquín Torriente acquiring a group of the properties of this family by foreclosure, including the Soledad Plantation. Later, in 1884, Atkins bought Torriente's assets (Scott 2007: 10; Rodríguez Eguiguren 2008: 73). The Atkins Sugar Estate was far from other human settlements and communicated with the main town of Cienfuegos by a railway that led to a dock located in Belmonte, on the banks of the Caunao River. From this site a small steamship carried passengers and goods across Cienfuegos Bay in a two-hour journey (Figure 1). By 1914, the property had over 7,203 ha, 40 km of railroad, and four locomotives (Lapique and Segundo 2011: 159–160).

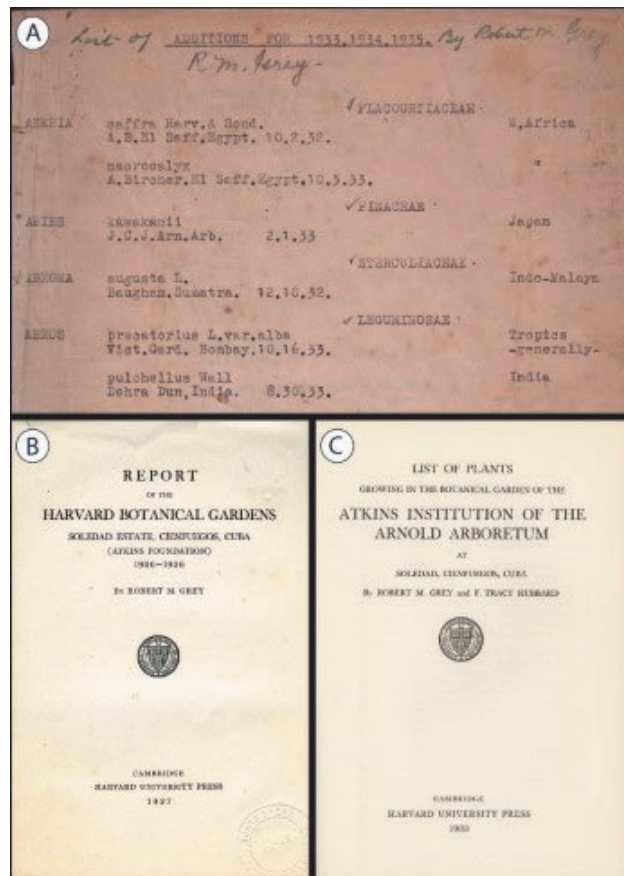
Sugar cane harvesting was the main economic activity of the estate, which included a sugar mill known as Central Soledad. In 1899 Atkins became interested in the possible development of better varieties of this crop through selection and crossing, for which he consulted Prof. George L. Goodale (1839–1923, Figure 8) and Prof. Oakes Ames (1874–1950, Figure 8), both from Harvard University (Barbour and Robinson 1940: 140). In 1900 Atkins met with them in Central Soledad, and it was decided to establish the “Harvard Botanic Station for Tropical Research and Sugar Cane Investigation.” This botanic station became part of the infrastructure and facilities of the Atkins Sugar Estate (Grey 1927: 3). Therefore, CBG was originally a joint endeavor between Atkins and Harvard University. The garden was formally inaugurated in September of 1901 on Colonia Limones (Grey 1927: 3), and it was also known informally as Soledad



**Figure 5.** Selection of correspondence excerpts that were examined in this study. (A) Letter of David Fairchild to Robert M. Grey from West Africa, dated 7-Feb.-1927. (B) Letter of Palemon H. Dorsett to the Fairchilds from Utowana, dated 23-Dec.-1927. (C) Letter of Robert M. Grey to Palemon H. Dorset from Cienfuegos Botanical Garden, dated 9-Feb.-1928. Courtesy of Archive and Library of Fairchild Botanic Garden.

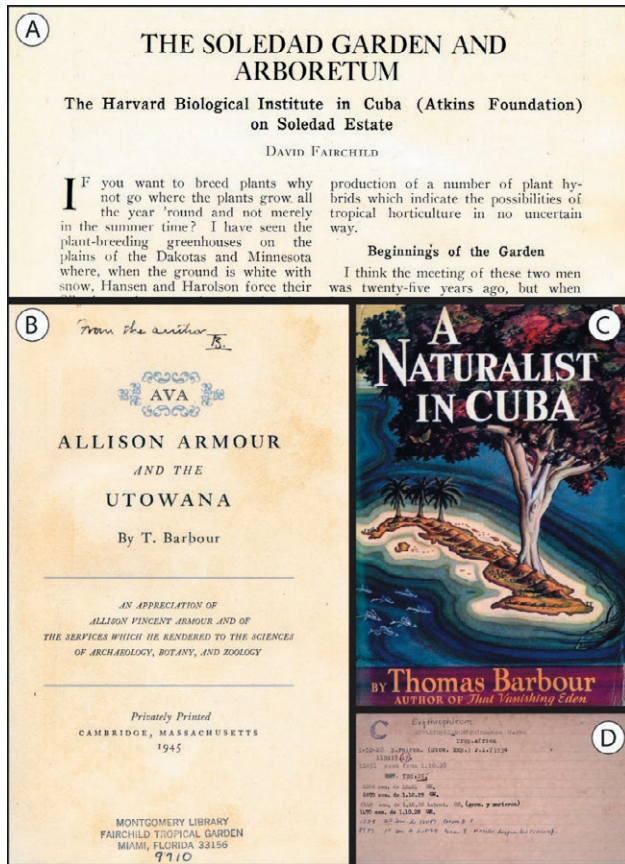
Garden or just as "Soledad." Prof. Ames, remotely from Harvard, became the first director of the station (Cahan 1991: 23, 31). Robert M. Grey (Figure 8), an experienced plant breeder, was named as superintendent, and he oversaw the actual garden operations until his retirement in 1936 (Merrill 1940: 74; Cahan 1991: 27). Through hybridization and selection procedures Grey was the first person to achieve a successful breeding program for sugar cane in Cuba (Clement et al. 1954: 1; Baró et al. 1985: 3; Fernández-Prieto 2018: 181), and he was one of the pioneers of this activity in the Caribbean region.

In 1919, Atkins transferred the administration and property of the garden to Harvard University. This operation included a substantial endowment of \$100,000. This undertaking had important consequences as it also included additional land (Cahan 1991: 28). The next rel-



**Figure 6.** Inventories of plant material cultivated in Cienfuegos Botanical Garden. (A) Unpublished account of plant introductions for the years 1933–1935 that was prepared by Robert M. Grey. (B) Cover of report published by Grey (1927). (C) Cover of report published by Grey and Hubbard (1933). Courtesy of Library of Cienfuegos Botanical Garden (A).

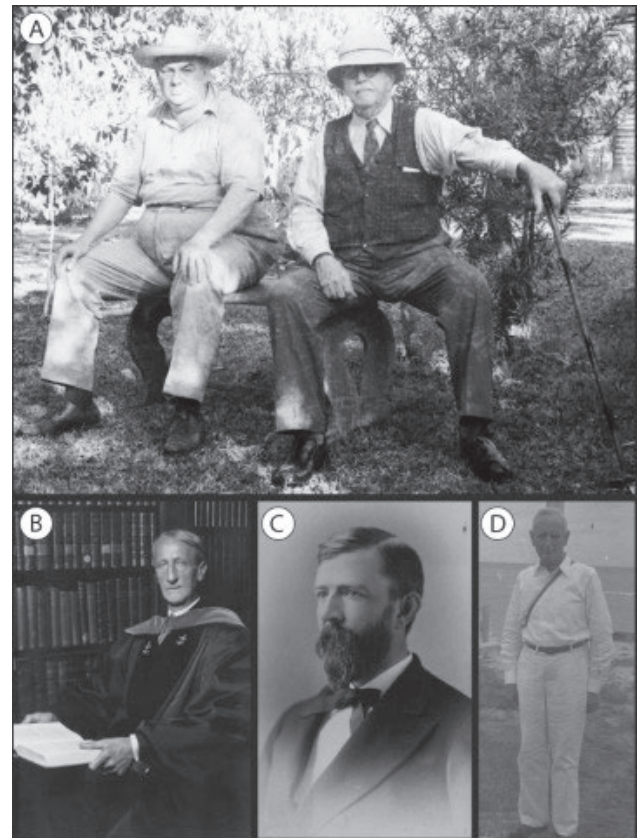
evant infrastructure development happened in 1924, when the "Harvard House" or "Casa Harvard" was opened (Figure 9). This was a building that had a small dormitory and a laboratory; and it was well equipped with a small herbarium, research instruments, and optical equipment to facilitate the work of visitors (Merrill 1940: 70). The construction of this facility marked a turning point that made CBG a truly scientific institution, surrounded by a unique living collection of tropical plants. Many students, faculty, and naturalists started visiting Soledad Garden and eventually this required the construction of a real dormitory. Built in 1938, this new building received the name of "Casa Catalina" to honor Mrs. Katharine Atkins (Figure 9), wife of Edwin Atkins. The project was jointly funded by her and Barbour (Merrill 1940: 72). Today, Harvard House functions as the administrative office of CBG. Casa Catalina



**Figure 7.** Relevant material consulted during this study. (A) Cover page of article published by Fairchild (1924) after his first visit to CBG. (B) Cover of book published by Barbour (1945a) pertinent to his expeditions on board *Utowana*. (C) Cover of book published by Barbour (1945b) on the natural history of Cuba. (D) Example of card that was used to record plants introduced in to CBG. Courtesy of Library of Cienfuegos Botanical Garden (D).

continues operating as a guest house, but it is also used for meetings, conferences, and as a place where technicians and researchers can have breaks during their regular working-hours. This infrastructure facilitated several higher education activities that included internships in tropical botany for students at Harvard University as well as summer courses with Carleton University in Ottawa, Harvard University, the Central University of Las Villas, Cuba and other Cuban educational institutions (Agüero and Ríos 1994: 13; Ojeda Quintana et al. 2007: 52). The first summer graduate course targeted students from Harvard University and took place in 1950 (Clement 1954a: 300–301, 1954b: 202).

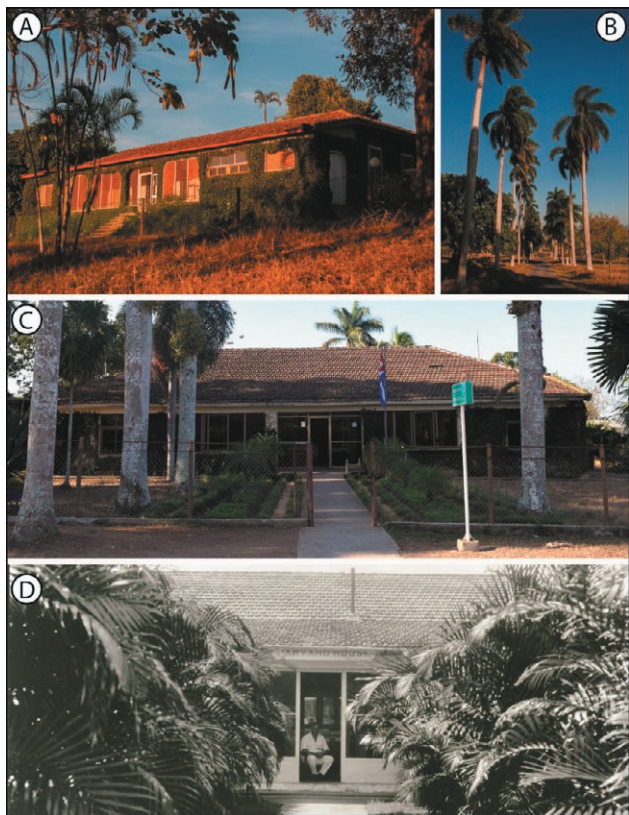
As the garden was expanding, new structures and facilities were built. They included ponds and small dams; water reservoirs; windmills to extract water from wells; and roads and bridges that facilitated access to the



**Figure 8.** Relevant personalities in the history of Cienfuegos Botanical Garden: (A) Thomas Barbour (left) and Robert M. Grey (right). (B) Oakes Ames. (C) George L. Goodale. (D) Frank G. Walsingham. Courtesy of Archive and Library of Fairchild Tropical Botanic Garden (A), Herbarium Library of Harvard University (B, C), and Library of Cienfuegos Botanical Garden (D).

different areas of the garden as shown in the plan made in 1933 (Figure 10). In 1950 the living collections were mapped (Clement 1954b: 199), and it is likely that this was the source for the current grid system that divides the garden into plots where plants are located (Figure 2). The arrangement is based on a network of 100 x 100 m<sup>2</sup> alpha-numeric squares; each of them further divided into four quadrants that are identified with Roman numerals. This mapping structure is still in place, and during our research it helped us to locate those plants that were associated with the *Utowana* expeditions (Figure 2). The garden was officially opened to the public in 1953 (Valiente 1953a, 1953b), and Clement (1956: 366) provided details on outreach and educational material that was then made available to visitors.

Since the early establishment of the garden, the Atkins were interested in plants that had gardening, ornamental, and economic value. Over the years, the



**Figure 9.** Sites of Cienfuegos Botanical Garden: (A) Casa Catalina. (B) Avenida de las Palmas or Palm Avenue. (C) Casa Harvard. (D) Casa Harvard, with Thomas Barbour sitting at the entrance door. Photo credits: Rosario Domínguez Basail (A, B), Rosalina Montes Espín (C). Courtesy of Archive and Library of Fairchild Tropical Botanic Garden (D).

garden has added forestry, horticulture, conservation, and education as central components of its mission. Mr. Grey facilitated the initial interests of the Atkins by starting to assemble a living collection that had a wide array of tropical species (Merrill 1940: 66). To build such a rich garden, he relied on several collaborators, mostly from the United States (Grey 1927: 9–10, 14). It is likely that Ames and Goodale facilitated these connections through the high reputation of Harvard University. It is worth mentioning that as the garden was growing conflicts occurred between Harvard and Atkins. Decisions needed to be made on whether sugar cane breeding or building a collection of tropical plants should be the main priority (reviewed by Fernández-Prieto 2018).

In 1927, one year after the death of Atkins, Prof. Thomas Barbour (1884–1946, Figure 8), director of the Museum of Comparative Zoology of Harvard University was appointed as the new garden director with the job title of “custodian” (Merrill 1940: 73). Barbour was

a prestigious naturalist and herpetologist with a wide experience in tropical biology and ecology (Barbour 1943; Bigelow 1952). Also by 1927, the site was officially known as “Harvard Botanical Gardens, Soledad Estate (Atkins Foundation)” as indicated in the cover page of the garden’s report that Grey (1927) wrote for the 1900–1926 period. This new name highlights how the garden was focusing more and more on the introduction of a wide range of tropical plants and not only on sugar cane breeding. Barbour spoke Spanish fluently, had a pleasant personality, and above all was familiar with the natural history of Cuba (Merrill 1940: 73; Barbour 1945b (Figure 7); Raby 2017: 73); therefore, it is not surprising that despite his training as a zoologist he was selected by Harvard to replace Ames who was more introvert and did not have Barbour’s background in the Spanish language and the Cuban biota (Raby 2017: 73). Barbour first visited the botanic station in 1909, and under his tenure the garden flourished. The presence of Barbour in Soledad contributed to the expansion of the garden activities into different disciplines such as medicine, agriculture, and basic research (Fernández-Prieto 2018: 171–172). The relevance of Barbour’s contribution to the history of CBG is stressed in a letter that Clement (1946) sent to Brother León shortly after Barbour passed away. This correspondence highlighted how the great Harvard professor supported the garden financially and was instrumental for the cultivation of plants from around the world; particularly palms, bamboos, and timber trees among many others. Some of these species, for instance teak (*Tectona grandis* L.f., Lamiaceae), was among the earliest plants introduced into Cuba that played a role in gardening, forestry, and horticulture.

Barbour had a solid friendship with David Fairchild (Fairchild 1946) and between 1928 and 1934 he joined four of the Caribbean expeditions of the Utowana (Barbour 1945a; Fairchild 1946, Figure 7). In 1932 the garden had another name change and became the “Atkins Institution of the Arnold Arboretum, Harvard University,” this formal affiliation with Harvard stressed the relevance that CBG had for this academic institution (Merrill 1940: 66).

In 1932, at the recommendation of David Fairchild, Frank G. Walsingham (Figure 8) arrived at Soledad as assistant superintendent (Walsingham 1932a, 1932b). He was graduated of the Kew gardening program; his mission was helping Grey to manage the plant records, the germplasm exchange program, and the regular routines involved in plant propagation (Merrill 1940: 74). He remained in the garden until his retirement in 1956, after which he returned to his native Scotland (Clement 1956). Walsingham was replaced by Ángel Valiente (1926–1988, Figure 3), a Cuban agronomist who gradu-

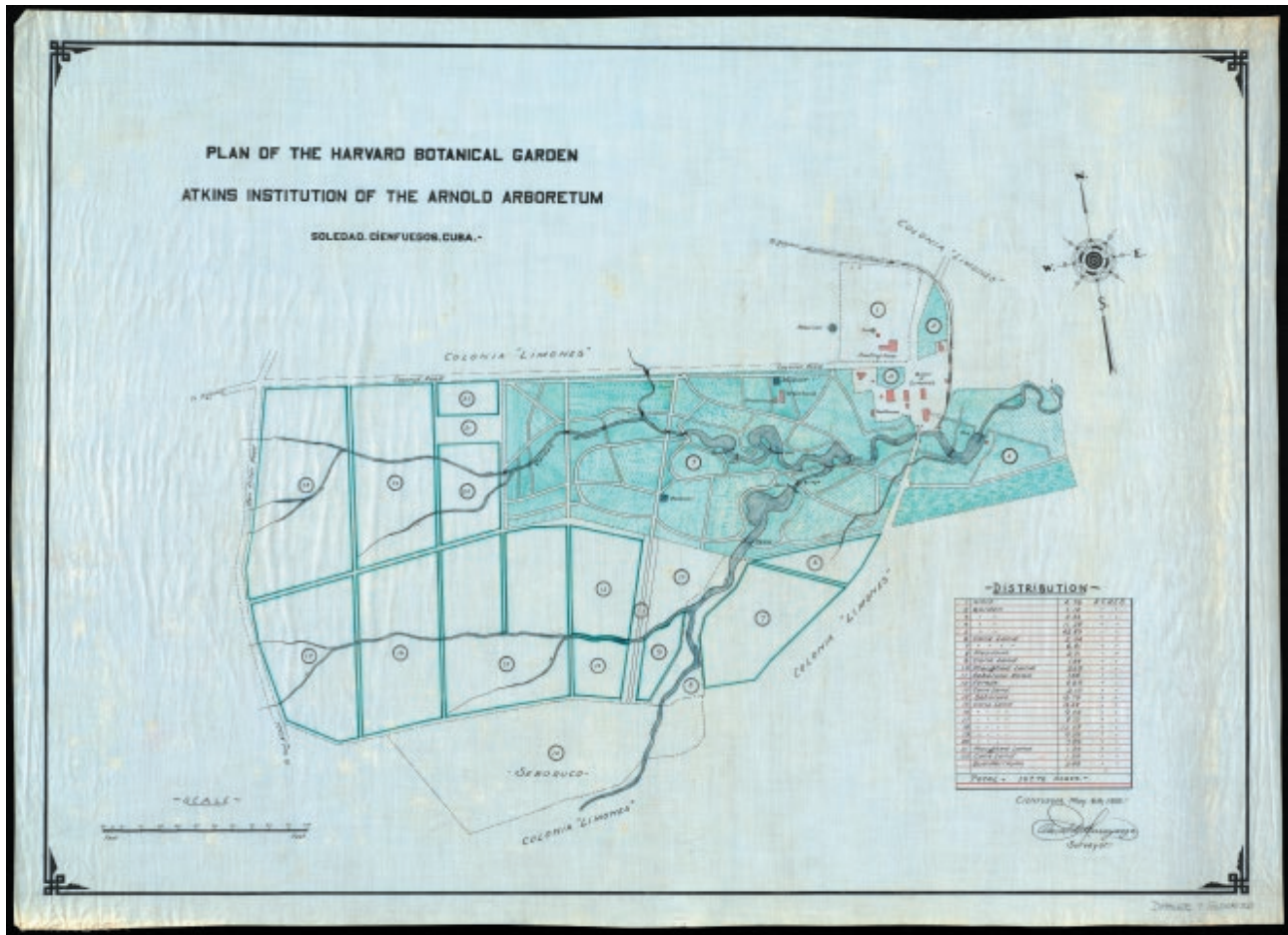


Figure 10. Plan of Cienfuegos Botanical Garden made by Oswaldo Binayaza in 1933. Courtesy of Arnold Arboretum.

ated from the Panamerican Agricultural School, Zamorano, Honduras (Aracelis Valiente pers. comm.). He proved to be an excellent administrator and was a key figure in 1960, when the garden started its transition from Harvard University to the Cuban Government. In 1962, Valiente was appointed director of CBG, a position that he held until 1982 (Agüero and Ríos 1994: 16).

The living collections of the garden built rapidly, and by December 1925 it had 1358 species (Grey 1927: 14). By 1933, this number increased to 1970, belonging to 921 genera and 165 families (Grey and Hubbar 1933: vi). More recently, in 1993, 1684 species representing 104 families were recorded (Rodríguez et al. 1993: 9, 217). The most recent inventory, from September 2020, accounted for 1962 species in 130 families. This living collection has plants from all over the world, and 80% of them are exotic species which are not native to Cuba (Ojeda Quintana et al. 2007: 54). The most important groups are palms, legumes, ficus, and bamboos. The garden surface area also increased over the years, initially it had 4.4 hectares but

by 1933 it was spread over 67.9 ha as indicated in the garden plan made by Oswaldo Binayaza (Figure 10). It currently has 94 ha, of which 73 ha are for the arboretum, 7 ha belong to the palmetum, 10 ha are devoted to natural forests, and the rest are for administration facilities, nurseries, exhibits, and marketing activities (Figure 1).

David Fairchild had a strong association with CBG, and in 1924 he made his first visit to Soledad (Fairchild 1924, Figure 7). Grey (1927: 10) reported that between 1905 and 1907 Fairchild sent to the garden samples of over 40 species. It appears that the first shipment was for a collection of *Vangueria infausta* Burrrch (Rubiaceae) that reached Soledad in 1905 (Grey and Hubbar 1933: 204). Grey (1936) recognized the importance of Fairchild in the early stages of the garden, and he stated: “as early as 1907 and 1908 a majority of the species were obtained through the kindness of Dr. David Fairchild [...] at that time, it was impossible to procure from any other source.”



**Table 1.** The eight research expeditions of Utowana that visited the Caribbean Islands.

Dates	Visited regions	Aim of expedition	Expedition members / Reference
January 3 – February 1, 1928 <sup>1</sup>	Cuba, Central America, Mexico	Plant surveys	Palemon Dorsett (USDA) / Dorsett (1927), Grey (1928), Higgins and Watson (1929)
February 10 – April 4, 1928 <sup>1</sup>	Cuba, Jamaica, Central America, Cayman Islands	Herpetological surveys	Thomas Barbour (Harvard University) <sup>2</sup> / Barbour (1928)
February 2 – April 15, 1929 <sup>1</sup>	Greater Antilles, Lesser Antilles, Trinidad and Tobago, Leeward Antilles, Colombia, Central America	Herpetological surveys and US Navy intelligence information	Thomas Barbour (Harvard University) / T. Barbour (1945), Henderson and Powell (2003)
February 3 – May 4, 1931 <sup>1</sup>	The Bahamas, Cuba, Cayman Islands, Central America, Mexico, Baja California	Plant, herpetological, and ornithological surveys	Thomas Barbour (Harvard University); Guy Collins, Thomas Kearney, James Kempton (USDA) / Armour (1931), T. Barbour (1945), M. Barbour (1945), Poe (2014)
December 30, 1931 – April 11, 1932	The Bahamas, Cuba, Hispaniola, Lesser Antilles, Trinidad and Tobago, Guyana, Suriname	Plant surveys	David Fairchild, Palemon Dorsett, Harold Loomis (USDA); Leonard Toy (University of Florida) / Dorsett (1936), Francisco-Ortega et al. (2019)
December 16, 1932 – January 10, 1933	The Bahamas, Cuba, Haiti	Apparently without a research mission	Haitian authorities / Anonymous (1933), Fairchild (1933), Barbour (1933)
February 16 – April 7, 1933 <sup>1</sup>	The Bahamas, Cuba, Cayman Islands, Jamaica, Swan Island, Panama	Plant, herpetological, and ornithological surveys	Thomas Barbour, James Greenway (Harvard University), David Fairchild (USDA) / Fairchild (1932–1942), T. Barbour (1945), Henderson and Powell (2003)
February 1 – April 20, 1934	The Bahamas, Hispaniola	Herpetological and archeological surveys	Thomas Barbour, James Greenway (Harvard University); Froelich Rainey (Yale University) / Rainey (1941, 1992), T. Barbour (1945), Henderson and Powell (2003)

<sup>1</sup> Expedition that visited Cienfuegos Botanical Garden.

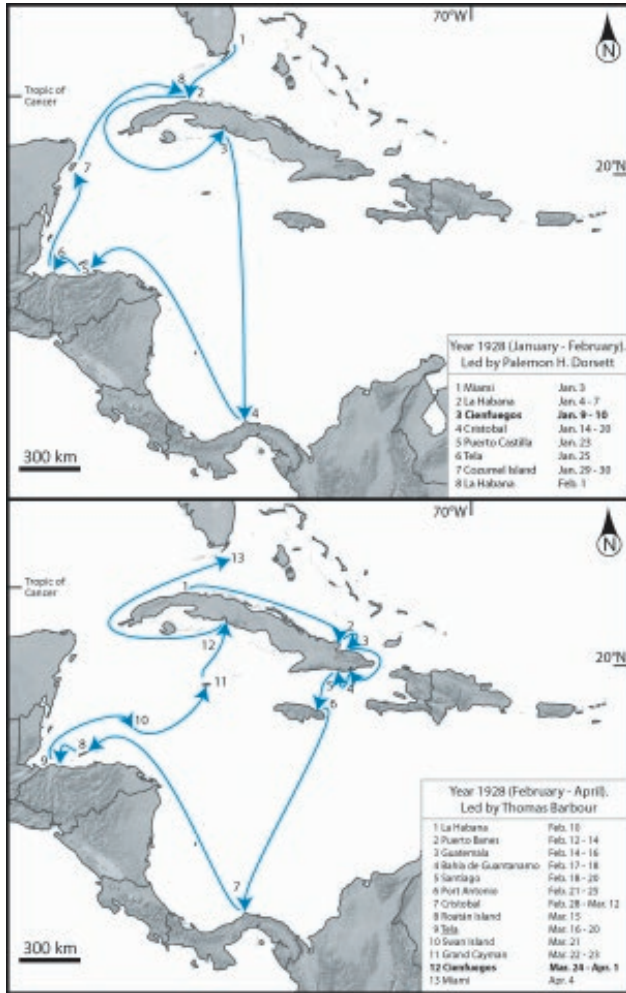
<sup>2</sup> Thomas Barbour joined the expedition in Panama.

### *Utowana expeditions: plant hunting in Africa, the Americas, Asia, and Europe*

Wealthy businessman Allison Armour (1863–1941) owned the Utowana, and he also provided financial support for the plant exploration expeditions that were undertaken on board this research yacht (Anonymous 1931a). Between 1925 and 1927 these plant hunting enterprises were led by David Fairchild and they only targeted the Old World including the Canary Islands, Portugal, Tropical West Africa, and the Western Mediterranean. Several accounts of the collected plants and activities pertinent to the 1925–1927 expeditions were subsequently published by Fairchild (1927a, 1927b, 1928a, 1928b, 1930a, 1930b, 1930c, 1930d, 1932, 1934b, 1939a, 1939b, 1950). In 1925 when the Utowana was cruising across the Mediterranean her engines failed and she could not take Fairchild and his team to Asia (Fairchild 1930a: 256, 262). Therefore, the portion of the trip that explored Java, Singapore, Sri Lanka, and Sumatra was carried out using commercial passenger ships; however, plant exploration in these regions was still spon-

sored by Armour and collections associated to these Asian expeditions have been included here as part of the Utowana endeavors. The trips to Sri Lanka and the Malay Archipelago were documented in the only known movie that shows David Fairchild (available online at: [https://www.youtube.com/watch?v=CU-Zcp\\_fpPg](https://www.youtube.com/watch?v=CU-Zcp_fpPg)). This particular motion picture was part of a set of three documentaries that represent the earliest films on plant hunting expeditions ever made (Francisco-Ortega et al. 2020). Relevant to our research, plant material collected during the 1925–1927 Utowana expeditions reached CBG (see below).

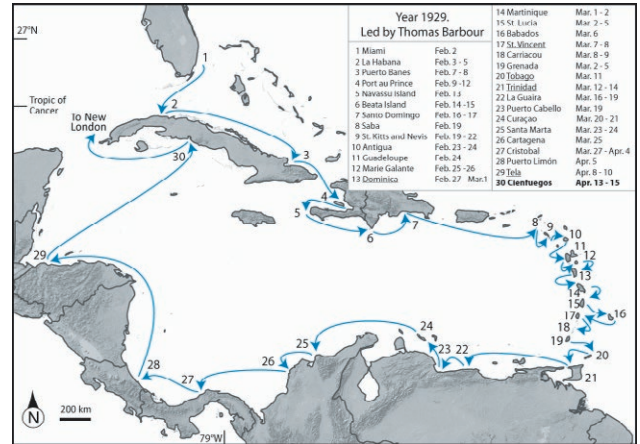
Between 1927 and 1934 the Utowana visited the Old and New World, including the Mediterranean region, Europe, the Azores, and the Caribbean Basin. These expeditions had a broader scope and not only focused on plant hunting but also on zoological and archeological research. Anonymous (1931a, 1932, 1934, 1935) provided details of the itineraries followed by these voyages. Brief descriptions for six of the eight trips of this vessel to the Caribbean Islands (Table 1) are listed below, as they were relevant to the building of the plant living collections of



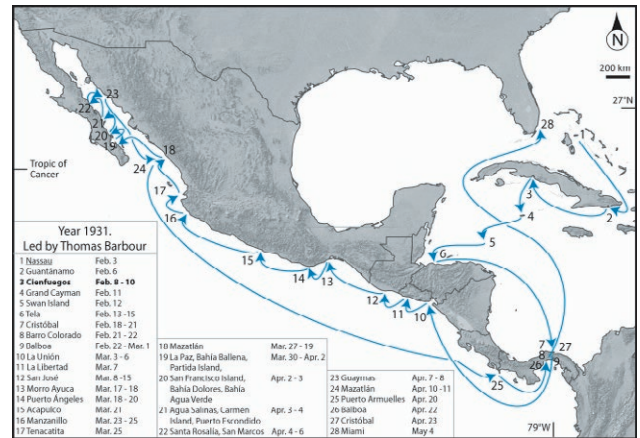
**Figure 11.** Itinerary followed by the research yacht *Utowana* during the two Caribbean expeditions of 1928. Notice that one expedition had Pamelon H. Dorsett (January 3 – February 1) as the leading naturalist and the second one had Thomas Barbour (February 10 – April 4) in this role.

CBG. David Fairchild only joined the 1931–1932, and the 1933 enterprises.

The first Caribbean trip of the *Utowana* took place in 1928 (Figure 11), between January 3 (Miami) and February 1 (Havana). Famous USDA plant explorer Pamelon H. Dorsett (1862–1943, Figure 3) was the only botanist who undertook this journey. We have not located any report or publication focusing on this voyage. However, we have found a few details of this trip through our archival research (Dorsett 1927, 1928; Grey 1928; Figure 5), and also the published “USDA Germplasm Inventory Reports” (Taylor and Ryerson 1929; Ryerson 1930) and “Annual Reports of the Canal Zone Plant Introduction Gardens” (Higgins and Watson

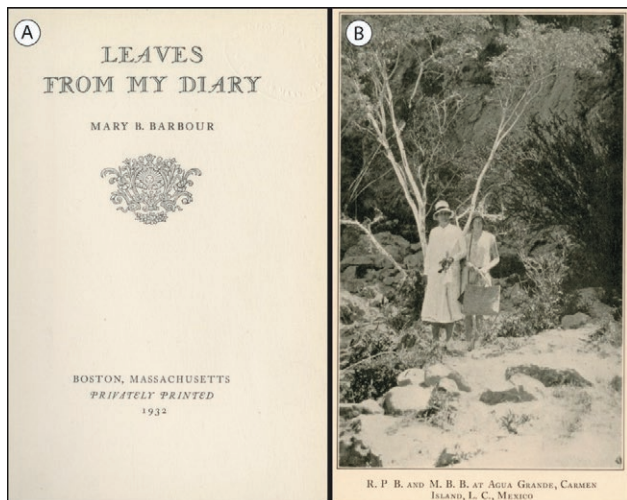


**Figure 12.** Itinerary followed by the research yacht *Utowana* during the Caribbean expedition of 1929. The expedition (February 2 – April 15) had Thomas Barbour as the leading naturalist.



**Figure 13.** Itinerary followed by the research yacht *Utowana* during the Caribbean expedition of 1931. The expedition (February 3 – May 4) had Thomas Barbour as the leading naturalist.

1929). Cienfuegos was the second visited locality (January 9–10). The main objective of this trip was to deliver plant material from the USDA germplasm repositories to CBG, the Summit Gardens in the Panama Canal Zone, and the Lancetilla Botanical Garden in Honduras. The Summit Gardens were managed by the Panama Canal governmental agency (Federal Register Executive Order 10263– July 1, 1951). In 1928, James E. Higgins (1873–1938) was its Agronomist in Charge before becoming its Director in 1930 (Croat 1971). Previously, Higgins had academic positions in the Philippines and in the Hawaiian Islands (Anonymous 1939). The Lancetilla Garden was owned and operated by the United Fruit Company (Plucknett et al. 1987: 56– 57; Hazlett 2017), and dur-

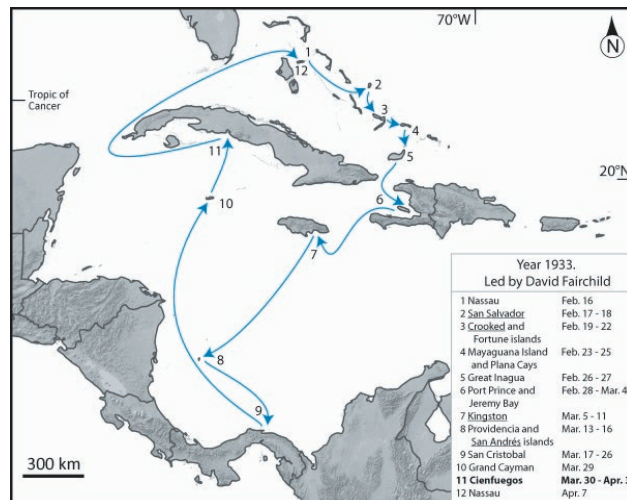


**Figure 14.** (A) Cover page of book published by Barbour (1932) that has the travelogue of the 1931 Utowana expedition to the Caribbean. (B) Rosamond P. Barbour (left) and her daughter Mary B. Barbour (right), photo reproduced from Barbour (1932).

ing Dorsett's visit, Wilson Popenoe (1892–1961, Figure 3) was its director. Prior to this appointment Popenoe worked for the USDA as an agricultural explorer under the supervision of David Fairchild (Woodger 1983). During his tenure with the USDA, Popenoe was a strong supporter of CBG, and Grey (1927: 14) indicated that he and Fairchild jointly arranged for Soledad to receive 50 species of tropical plants from this federal agency just between 1925 and 1926.

Following Dorsett's trip, it seems that Barbour was the only naturalist who participated in the second voyage of the Utowana to the Caribbean Basin (Figure 11). This trip took place in 1928, and it also visited Cienfuegos (March 24 – April 1). The journey started on February 10 (Havana) and ended on April 4 (Miami). The expedition resulted in a publication on the reptile fauna of Bay Islands, Honduras (Barbour 1928). Barbour only took part in the last portion of the trip as he joined the vessel in Panama (Barbour 1945a: 8). Plant material collected during this expedition was brought to CBG (see below).

The third of the Utowana's journeys to the Caribbean took place in 1929 (February 2, Miami through April 15, Cienfuegos). This was an extensive trip to Cuba, Hispaniola, Lesser Antilles, Tobago, Trinidad, Venezuela, Colombia, and Central America that also included visits to the Lancetilla and Summit gardens (Figure 12). No botanists joined this expedition, and it seems that one of the main aims of the trip was to obtain "certain confidential information" for the US Navy from the Lesser Antilles (Barbour 1943: 125, 1945a: 10). Details of the zoological outcomes of the expedition were reviewed by



**Figure 15.** Itinerary followed by the research yacht Utowana during the Caribbean expedition of 1933. The expedition (February 16 – April 7) had David Fairchild as the leading botanist.

Henderson and Powell (2004). Barbour (1943: 124–131, 1945a: 10–20) provided an extensive account of the itinerary. Interestingly, one of the objectives of this trip was to collect plant material in the Lesser Antilles to be introduced into Florida (Barbour 1943: 125). Some of this material was also delivered to CBG (see below).

Between February 3 (Nassau) and May 4 (Miami), 1931 the Utowana undertook the longest of her trips to the region (Figure 13). The yacht visited the Caribbean Basin (Cuba, Cayman Islands, Swan Island, Panama, and Honduras), crossed the Panama Isthmus, and cruised along the Pacific coasts of the Central America, Mexico, and the Gulf of California. Cienfuegos (February 8–10) was the third site visited during this journey. Barbour and three plant explorers from the USDA [Guy N. Collins (1872–1938, Figure 3), Thomas H. Kearney (1874–1956), and James Howard Kempton (1891–1970)] were the four biologists of this expedition. Collins' agricultural research focused on avocado and corn, while Kempton was a corn breeder (Fairchild 1938b; Rhoades 1984). Kearney joined the Utowana in Mazatlán, Mexico (M. Barbour 1932: 77), whereas the other two USDA plants explorers took part in the complete expedition. Kearney was an expert in cotton breeding (Kearney 1958). Wilson Popenoe (see above) was on the expedition between El Salvador and Guatemala (Armour 1931: 3). The three main plant genetic resources goals of the expedition were collecting: (1) corn relatives in Guatemala; (2) landraces and wild species of cotton in the Caribbean Islands and Baja California, respectively; and (3) wild species of avocado for breeding and graft-

ing in Central America and Mexico. The team also collected plant material in the gardens of Lancetilla, Summit, and the San Salvador Experimental Station (Armour 1931: 2); therefore, bringing plants to CBG was not one of the aims of the voyage (see below). Barbour (1945a: 21–35) wrote extensively about this trip, and Poe (2014) reviewed the main zoological findings. Furthermore, Armour (1931) prepared a report for the USDA on the main plant hunting highlights of this enterprise. Armour's (1931) account includes 43 photos of CBG, but it does not include additional details of this garden. Barbour's daughter, Mary Barbour Kidder (1917–1977, Figure 14), also took part in the expedition, and wrote a diary (Figure 14) that has relevant details on several of the activities of the trip. From Mary Barbour's (1932: 19–23) work we know that during the Utowana's visits to Cienfuegos, the vessel anchored in Cienfuegos Bay. From there, expedition members moved to a small boat that navigated along the Caunao River, until reaching Belmonte. From this site, the team had a train ride to the town of Pepito Tey (then known as Soledad) where the CBG is located (Figure 1). Once in Pepito Tey they stayed in the Atkins's family house.

The fourth voyage of the Utowana to the Caribbean was led by David Fairchild. This expedition started and ended in Miami (December 31, 1931 – April 1, 1932) and targeted the Caribbean Islands, Guyana, and Suriname. Cuba (Guantanamo) was visited, but Cienfuegos was not included in this trip. Studies pertinent to this expedition, including its itinerary map, were previously published by Francisco-Ortega et al. (2018, 2019), Camas et al. (2020), and Chavarria et al. (2020). During this journey hundreds of germplasm collections were made, and many of them eventually reached CBG (see below).

In 1933 the Utowana made her last visit to Cienfuegos (March 30 – April 3), and this was an expedition with zoological and botanical activities that were jointly led by Fairchild and Barbour (Figure 15). Details on the plant hunting activities performed in Jamaica and Haiti were studied by Rose et al. (2017) and Francisco-Ortega et al. (2018), respectively. Henderson and Powell (2004) reviewed the main zoological highlights of this venture. Portions of this trip were described in an unpublished diary written by Fairchild (1932–1942), which is currently under study by our team, and Barbour (1945a: 35–38) provided additional descriptions of this voyage. The expedition (February 16 – April 7) started and ended in Nassau. Many germplasm accessions were introduced into CBG (see below). The trip also had an ornithological component, and James C. Greenway (1903–1989), a colleague of Barbour from Harvard University, was the third naturalist who participated in the endeavor.

#### PLANT MATERIAL INTRODUCED THROUGH THE UTOWANA EXPEDITIONS

Plant exploration expeditions on board the Utowana led to the introduction of 278 accessions (254 species) of plants into CBG (Tables 2–3). Arecaceae (52 species), Fabaceae (45 species), Moraceae (13 species, mostly in the genus *Ficus*), Orchidaceae (11 species), Malvaceae (10 species), and Rubiaceae (10 species) were the six families with the highest number of species (Table 3). Currently 57 of the species (132 individuals) that were brought to CBG through Utowana expeditions are still cultivated in the living collections of this garden (Figure 2, Online Supplementary Table 1).

The collections introduced in CBG through Utowana had a wide geographical origin (Table 4). Twenty-one species were Caribbean Island endemics, and 93 accessions (86 species) were restricted to the rest of the New World. However, most of them were Old World species (144 accessions, 128 species).

One hundred and thirteen of the introduced accessions (113 species) were collected in botanic gardens or research stations (Table 5) located in Africa (11 species), Asia (25 species), the Canary Islands (one species), the Caribbean Islands (40 species), Panama [five accessions (five species), two of them from Summit and three from Ancon and Barro Colorado Island], Honduras (23 species, all of them from Lancetilla) or Guyana (11 species). A total of 21 botanical gardens or research stations contributed material to CBG. Most of them were New World (13) institutions that were visited during the expeditions of Barbour in 1928 and 1929, Fairchild in 1931–1932, and Fairchild in 1933. The Trinidad Botanic Garden and St. Vincent Botanic Garden were visited twice, during the Barbour 1929 and Fairchild 1931–1932 Utowana expeditions. The remaining gardens were from Asia (5), Africa (2) and one from the Mediterranean. These other samples were collected during the Utowana 1925–1927 expedition to the Old World. Among all the gardens that provided plant material to Soledad, Lancetilla contributed with the highest number of species (22).

This material was not only important to CBG but also to other gardens and institutions in Cuba. Twenty one of these “Utowana species” provided germplasm that were shipped to eleven additional sites in Cuba. The recipients included private gardens, arboreta, tree fruit plantations, botanic gardens, germplasm banks, and experimental stations (Table 6). Five of these 21 species were sent because of their ornamental value, twelve for food production, five for forestry and reforestation projects, two as potential sources of natural medicines and

**Table 2.** Overview of material that reached Cienfuegos Botanical Garden (CBG) that was collected during Utowana's plant hunting endeavors. Plant material was introduced either directly during the actual expeditions or indirectly through shipments from the USDA Germplasm Repositories, Kampong Gardens (private residence of David Fairchild in Coconut Grove, Miami, Florida), or Harvard University.

Source of material collected during Utowana expeditions that was received by CBG	Source of the collections (Number of species / accessions) <sup>1</sup>										Total number of species / accessions that were shipped or delivered to CBG	
	Utowana 1925–1927 (Africa, mainland Spain, Canary Islands)	Utowana 1925–1927 (Asia)	Barbour 1928	Barbour 1929	Barbour 1931	Fairchild 1931–1932	Fairchild 1933	Utowana collections from USDA Germplasm Repositories	Kampong	Unknown sources		
Utowana 1925–1927 (Africa, mainland Spain, Canary Islands) <sup>2</sup>	1/1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1/1
Utowana 1925–1927 (Asia) <sup>3</sup>	NA	8/8	NA	NA	NA	NA	NA	NA	NA	NA	NA	8/8
Dorsett 1928 <sup>4</sup>	46/47	14/14	NA	NA	NA	NA	NA	9/9	0/0	1/1	0/0	70/71
Barbour 1928 <sup>4</sup>	0/0	0/0	22/22	NA	NA	NA	NA	0/0	0/0	0/0	0/0	22/22
Barbour 1929 <sup>4</sup>	0/0	0/0	0/0	25/25	NA	NA	NA	0/0	0/0	2/2	0/0	27/27
Barbour 1931 <sup>4</sup>	0/0	0/0	0/0	0/0	1/1	NA	NA	0/0	0/0	2/2	0/0	3/3
Fairchild 1933 <sup>4</sup>	1/1	1/1	0/0	0/0	0/0	0/0	20/20	1/1	8/8	7/7	NA	37/38
Mailed from Harvard University, Kampong or USDA <sup>5</sup>	8/9	5/5	1/1	4/5	0/0	81/83	4/4	1/1	NA	NA	NA	104/108

<sup>1</sup> Utowana expeditions are coded as: Utowana 1925–1927: Utowana expedition to the Old World that took place between 1925 and 1927, David Fairchild was its leader. Dorsett 1928: Utowana expedition that took place between January 3 and February 1, 1928, itinerary is shown in Figure 11, and Palemon Dorsett was its leader. Barbour 1928: Utowana expedition that took place between February 10 and April 4, 1928, itinerary is shown in Figure 11, and Thomas Barbour was its leader. Barbour 1929: Utowana expedition that took place between February 2 and April 15, 1929, itinerary is shown in Figure 12, and Thomas Barbour was its leader. Barbour 1931: Utowana expedition that took place between February 3 and May 4, 1931, itinerary is shown in Figure 13, and Thomas Barbour was its leader. Fairchild 1931–1932: Utowana expedition that took place between December 30, 1931 and April 2, 1932; David Fairchild was its leader. Fairchild 1933: Utowana expedition that took place between February 16 and April 7, 1933, itinerary is shown in Figure 15, and David Fairchild was its botanical leader. Kampong: private garden of David Fairchild is located in Coconut Grove, Miami, Florida.

<sup>2</sup> 1925 – 1927 Utowana expedition to the Old World. Material was shipped directly from West Africa to CBG.

<sup>3</sup> 1925 – 1927 Utowana expedition to the Old World. Material was shipped directly from Sri Lanka to CBG.

<sup>4</sup> Utowana expedition that visited CBG and delivered material to this botanic garden. See note 1 for expedition codes.

<sup>5</sup> Plant material collected during Utowana expeditions that was shipped to CBG from Harvard University, Kampong or USDA.

**Table 3.** Taxonomic diversity of plant material introduced in Cienfuegos Botanical Garden through Utowana expeditions.

Family	Number of species	Number of accessions	Family	Number of species	Number of accessions
Acanthaceae	1	1	Marantaceae	1	1
Achariaceae	1	1	Meliaceae	2	4
Amaryllidaceae	1	1	Moraceae	13	16
Annonaceae	3	3	Musaceae	1	1
Apocynaceae	8	9	Myristicaceae	1	1
Araceae	5	6	Myrtaceae	2	2
Arecaceae	52	60	Nyctaginaceae	1	1
Aristolochiaceae	1	1	Ochnaceae	1	1
Asparagaceae	6	6	Oleaceae	1	1
Begoniaceae	2	2	Orchidaceae	11	12
Bignoniaceae	3	3	Oxalidaceae	1	1
Boraginaceae	1	1	Passifloraceae	2	2
Bromeliaceae	2	2	Piperaceae	2	2
Cactaceae	3	3	Poaceae	4	4
Canellaceae	1	1	Polygonaceae	2	2
Capparaceae	1	1	Polypodiaceae	1	1
Celastraceae	1	1	Rhamnaceae	2	2
Clusiaceae	6	8	Rosaceae	1	1
Combretaceae	4	4	Rubiaceae	10	10
Costaceae	2	2	Rutaceae	1	1
Cupressaceae	1	1	Salicaceae	1	1
Dioscoriaceae	2	2	Sapotaceae	4	6
Ebenaceae	3	3	Solanaceae	1	1
Euphorbiaceae	2	2	Stegnospemataceae	1	1
Fabaceae	45	47	Talinaceae	1	1
Iridaceae	1	1	Urticaceae	1	1
Lamiaceae	4	4	Verbenaceae	1	1
Lauraceae	1	2	Vitaceae	1	1
Lecythidaceae	3	4	Zingiberaceae	3	3
Loganiaceae	1	1	Zygophyllaceae	1	1
Malpighiaceae	1	1	<b>TOTAL</b>	<b>254</b>	<b>278</b>
Malvaceae	11	11			

tannins; finally, 14 of these species were included in conservation projects or added to the living collections of the recipient institutes.

#### *The 1925–1927 Utowana plant exploration expeditions to the Old World*

The first voyage of David Fairchild on board the Utowana started in 1925, one year after he made his initial visit to Soledad (Fairchild 1924). During this expedition he sent seed samples of 14 species directly from Sri Lanka to Cienfuegos (Fairchild 1926); however, based on the CBG records only eight of these accessions appear to have reached its living collections (Table 2). Further-

more, in a letter that Fairchild sent to Grey from Cameroon, it is indicated that one sample of *Lasimorpha senegalensis* was sent from this country to CBG during this expedition (Fairchild 1927c).

Additional archival research confirmed that samples collected by David Fairchild during the 1925–1927 Utowana plant exploration expedition to the Old World were sent to CBG from USDA repositories in the United States (77 accessions representing 72 species). Among them, 63 accessions (62 species) were delivered through Utowana trips that visited Cienfuegos. Most of these accessions (61 accessions, 60 species) were brought by Dorsett during his 1928 trip to the Caribbean Basin (Table 2). The Utowana also delivered one of these Old-World accessions during the 1933 expedition that Fair-

**Table 4.** Biogeography of plant material introduced in Cienfuegos Botanical Garden through plant exploration expeditions on board the Utowana<sup>1</sup>.

Region	Number of species	Number of accessions
Africa	47	54
Asia	39	42
Africa and Asia	8	8
Australasia and Pacific Basin	24	30
Caribbean Islands	21	21
Europe and Mediterranean Basin	2	2
Old World	8	8
New and Old World	16	17
New World	86	93
<b>TOTAL</b>	<b>251</b>	<b>275</b>

<sup>1</sup>Biogeographical regions could not be assigned to three species whose names were not found in the consulted taxonomic literature (i.e., *Bougainvillea warszewiczii* Hort., *Hibiscus collinsii* Hort., *Ficus waringiana* Hort.). They appear to refer to cultivars of unknown species.

child and Barbour led to the region. The rest of the Old-World samples (12 collections, 13 species) were not brought by this vessel, and it is likely that they were sent directly from the USDA through alternative paths.

#### *The 1928–1933 Utowana plant exploration expeditions to the Caribbean*

The first visit of the Utowana to Cienfuegos occurred in 1928, and 71 accessions (70 species) were introduced in Soledad (Table 2). All of them came from USDA repositories, the vast majority (62 accessions, 60 species) were collected during the 1925–1927 Utowana expedition to the Old World. Nine species (nine accessions) that came from other Utowana voyages were also carried to CBG by Dorsett during this trip. Only one collection did not belong to material that was obtained during an Utowana endeavor.

Barbour was apparently the only naturalist who joined the second Utowana expedition (year 1928) that stopped in Cienfuegos. During this trip, he introduced 22 collections (22 species) from Lancetilla Botanical Garden into CBG (Online Supplementary Table 1). This was the only material that this expedition brought to Soledad (Table 2).

In 1929 Barbour headed the next Utowana voyage that visited Cienfuegos. During this trip 25 accessions (25 species) were collected and carried to CBG. This material came from Trinidad and the Lesser Antilles. Two additional accessions were introduced into this

garden through this expedition, but they have unknown provenance (Table 2).

Under the leadership of Barbour, the 1931 Utowana expedition brought only three accessions (three species) to Soledad (Table 2). None of them were collected during this voyage. One of these accessions came from the 1929 Utowana expedition to the Caribbean Islands, but the reminding two samples had an unknown origin and were not collected on previous Utowana voyages.

The last visit of the Utowana to Cienfuegos was in 1933, and the trip was led by Fairchild and Barbour. A wide array of collections was brought to Soledad during this journey (Table 2). Twenty of these samples (20 species) were collected during this expedition. Material from the 1925–1927 Utowana voyage to the Old World (two species) was also delivered. Interestingly, this 1933 trip also brought germplasm from the private gardens of Fairchild in Coconut Grove, Miami (eight collections, eight species). This site is known as The Kampong and is currently owned and operated by the National Tropical Botanical Garden. Finally, through the 1933 visit, material of unknown provenance or from the USDA collections was also introduced into Soledad (eight collections, eight species).

#### *Utowana collections sent from USDA germplasm repositories and Harvard University*

We found that 108 accessions (104 species) from Utowana expeditions were not brought to Soledad on board the Utowana, but they reached the garden through other channels (Table 2). This material was mailed directly, or personally carried by visitors or by members of the Atkins family from Harvard University, or the USDA germplasm repositories or The Kampong (Online Supplementary Table 1). Most of this material (83 accessions, 81 species) was collected during the 1931–1932 Utowana voyage to the Caribbean Islands and Guianas (Table 2). From the collection books of David Fairchild, we are certain that USDA facilities located in Miami (Chapman Field) and Washington DC were recipients of Utowana material; however, we have not found details of the precise USDA germplasm repositories that sourced the accessions that were sent to Soledad.

## DISCUSSION

Following the 1898 Spanish-American war, the United States became the predominant political power in the Caribbean, and a new era dominated by neocolonialist

**Table 5.** Botanic gardens and research stations that provided material to Cienfuegos Botanical Garden through Utowana expeditions.

Botanic garden/research station provenance	Source of plant introduction <sup>1</sup>	Route of arrival of the material to CBG <sup>1</sup>	Number of species / accessions
Agricultural Experiment Station, Aburi, Ghana	1925–1927 Old World Expedition (Africa)	Dorsett 1928	2/2
Agricultural Experiment Station, Tortola	Fairchild 1933	Mailed from USDA	1/1
Antigua Botanic Garden	Fairchild 1933–1932	Mailed from USDA	1/1
Bath Botanic Garden, Jamaica	Fairchild 1931–1932	Mailed from USDA	1/1
Botanic Garden of Buitenzorg, Java	USDA germplasm repositories <sup>2</sup>	Dorsett 1928	3/3
Botanic Station of Scarborough, Tobago	Fairchild 1931–1932	Mailed from USDA	1/1
Castleton Garden, Jamaica	Fairchild 1933	Fairchild 1933	1/1
Dominica Botanic Garden	Barbour 1929	Mailed from USDA	1/1
		Barbour 1929	7/7
		Mailed from USDA	2/2
Grenada Botanic Garden	Fairchild 1931–1932	Mailed from Harvard University	1/1
		Mailed from USDA	5/5
Guyana Botanic Garden	Fairchild 1931–1932	Mailed from USDA	11/11
Hope Garden, Jamaica	Fairchild 1933	Fairchild 1933	4/4
		Mailed from USDA	1/1
Lancetilla, Tela, Honduras	Barbour 1928	Barbour 1928	22/22
		Mailed from Harvard University	1/1
Lloyd Botanic Garden, Darjeeling, India	USDA germplasm repository <sup>2</sup>	Dorsett 1928	1/1
Orotava Botanic Garden, Canary Islands	1925–1927 Old World Expedition (Macaronesia)	Dorsett 1928	1/1
Peradeniya Botanic Garden, Sri Lanka	1925–1927 Old World Expedition (Asia)	Dorsett 1928	7/7
		Mailed directly from Sri Lanka ( <i>Utowana</i> Expedition)	7/7
		Mailed from USDA	2/2
Sibolangit Botanic Garden, Sumatra	1925–1927 Old World Expedition (Asia)	Dorsett 1928	1/1
Singapore Botanic Garden	1925–1927 Old World Expedition (Asia)	Mailed from USDA	1/1
St. Vincent Botanic Garden	Fairchild 1931–1932	Mailed from USDA	3/3
		Barbour 1929	Mailed from Harvard University
Summit Gardens, Panamá	Fairchild 1933	Fairchild 1933	2/2
Trinidad Botanic Garden	Barbour 1929	Barbour 1929	5/5
		Fairchild 1931–1932	Mailed from USDA
Victoria Botanic Garden, Cameroon	1925–1927 Old World Expedition (Africa)	Dorsett 1928	7/7
		Fairchild 1933	1/1
		Mailed from USDA	1/1
<b>Total number of species / accessions</b>	<b>113/113</b>		

<sup>1</sup> Utowana expeditions are coded in Table 1.<sup>2</sup> Material was brought by Dorsett from USDA germplasm repositories but it was not originally collected during an Utowana expedition.

policies started in the region (Foner 1972). This was particularly relevant during the first third of the 20<sup>th</sup> century when the United States leased or added unincorporated territories to its jurisdiction. This included portions of land from Cuba (Strauss 2009) and Panama, both

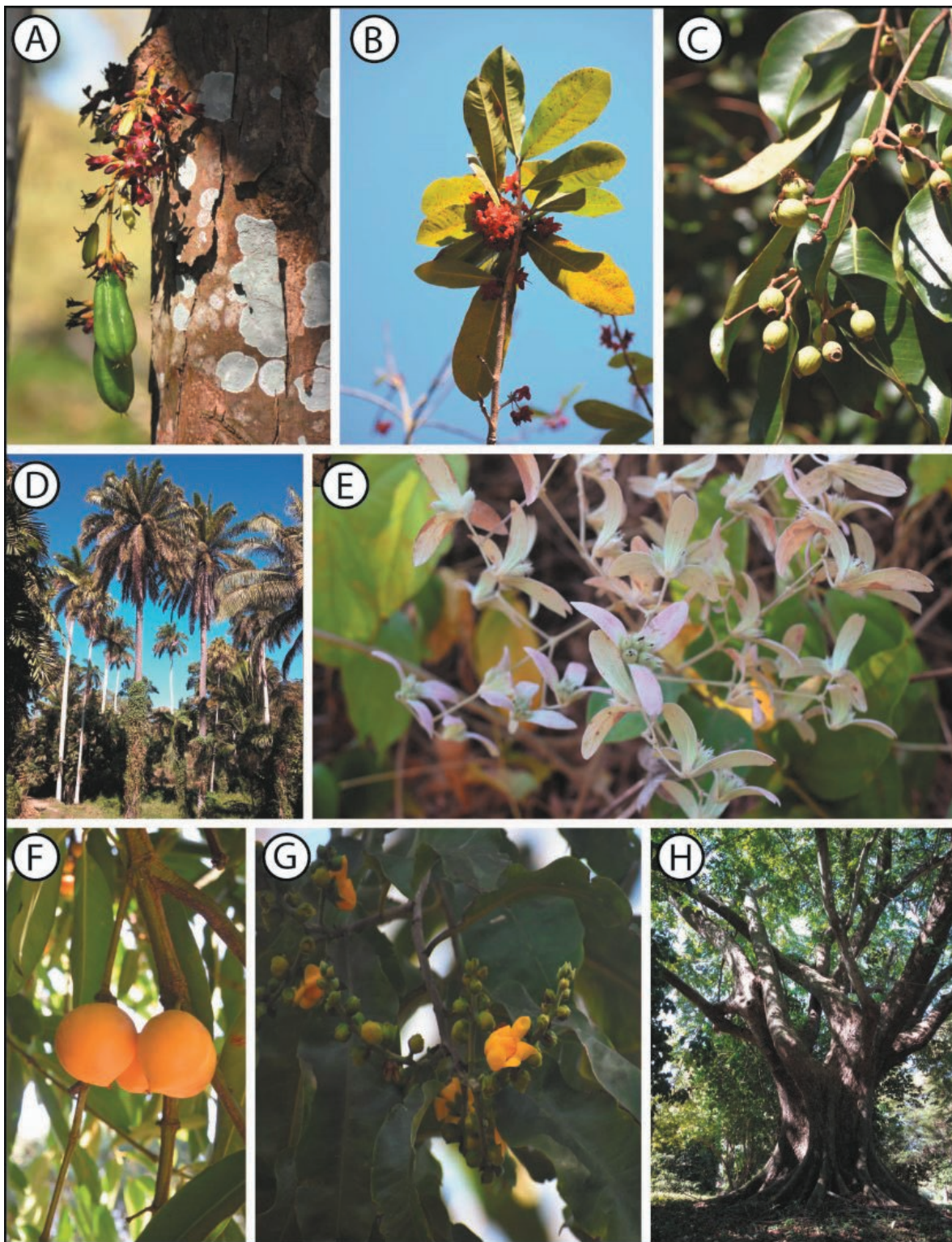
in 1903 (Major 1993). Furthermore, during this period American troops intervened in countries such as Cuba (between 1917 and 1922), Haiti (between 1915 and 1934), and the Dominican Republic (between 1916 and 1924), as reviewed by Pérez Jr. (1979), Renda (2001), and Cal-



**Table 6.** Material linked to Utowana expeditions that was sent from Cienfuegos Botanical Garden to other Cuban centers, farms, plant genetic resources stations or institutions.

Species <sup>1</sup>	Recipient / Province	Species <sup>1</sup>	Recipient / Province
<i>Averrhoa bilimbi</i> <sup>2</sup>	El Nicho fruit farm, Ministry of Agriculture / Cienfuegos	<i>Garcinia dulcis</i> <sup>2,3</sup>	Ingenito farm, owned by Ricardo Denis / Sancti Spiritus
<i>Bambusa blumeana</i> <sup>3,4</sup>	Camagüey Botanical Garden / Camagüey Bamboo Project/ Holguín Bamboo germplasm bank of Topes de Collantes / Sancti Spiritus		El Nicho Fruit Farm, Ministry of Agriculture / Cienfuegos Pinar del Río Botanical Garden / Pinar del Río Camagüey Botanical Garden / Camagüey
<i>Borassus flabellifer</i> <sup>3</sup>	Camagüey Botanical Garden / Camagüey	<i>Guadua angustifolia</i> <sup>4</sup>	Bamboo germplasm bank of Topes de Collantes / Sancti Spiritus Camagüey Botanical Garden / Camagüey
<i>Brownea coccinea</i> <sup>3,5</sup>	Villa Clara Botanical Garden / Villa Clara	<i>Lecythis minor</i> <sup>2,3</sup>	El Nicho Fruit Farm, Ministry of Agriculture / Cienfuegos Pinar del Río Botanical Garden / Pinar del Río Camagüey Botanical Garden / Camagüey
<i>Brownea macrophylla</i> <sup>3,5</sup>	Ingenito farm, owned by Ricardo Denis / Sancti Spiritus Villa Clara Botanical Garden / Villa Clara	<i>Lecythis tuyrana</i> <sup>2,3</sup>	Jovellanos fruit farm, owned by Héctor Correa / Matanzas Pinar del Río Botanical Garden / Pinar del Río
<i>Caryota mitis</i> <sup>3,5</sup>	Villa Clara Botanical Garden / Villa Clara	<i>Payena leerii</i> <sup>5</sup>	Topes de Collantes Arboretum/ Sancti Spiritus
<i>Cassia grandis</i> <sup>3,6</sup>	El Nicho Fruit Farm, Ministry of Agriculture / Cienfuegos	<i>Pericopsis mooniana</i> <sup>4,5,6</sup>	Ingenito farm, owned by Ricardo Denis / Sancti Spiritus
<i>Dendrocalamus sikkimensis</i> <sup>4</sup>	Bamboo Project/ Holguín Camagüey Botanical Garden / Camagüey Bamboo germplasm bank of Topes de Collantes / Sancti Spiritus.	<i>Phoenix</i> sp. <sup>3</sup>	Villa Clara Botanical Garden / Villa Clara
<i>Dialium guineense</i> <sup>2,3</sup>	Forage and Fodder Experimental Station of Indio Hatuey / Mayabeque Ingenito farm, owned by Ricardo Denis / Sancti Spiritus Jovellanos fruit farm, owned by Héctor Correa / Matanzas Pinar del Río Botanical Garden / Pinar del Río Camagüey Botanical Garden / Camagüey	<i>Ptychosperma macarthurii</i> <sup>5</sup>	La Chata farm, owned by ex-president Carlos Prío / La Habana Quinta de Los Molinos / La Habana Villa Clara Botanical Garden / Villa Clara
<i>Elaeis guineensis</i> <sup>2,3,5</sup>	El Nicho Fruit Farm, Ministry of Agriculture / Cienfuegos Jovellanos fruit farm, owned by Héctor Correa / Matanzas Camagüey Botanical Garden / Camagüey National Botanical Garden / La Habana <sup>7</sup> Jovellanos fruit farm, owned by Héctor Correa / Matanzas	<i>Roystonea oleracea</i> <sup>3</sup>	Ingenito farm, owned by Ricardo Denis / Sancti Spiritus
<i>Ficus sur</i> <sup>2,3</sup>	Ingenito farm, owned by Ricardo Denis / Sancti Spiritus El Nicho Fruit Farm, Ministry of Agriculture / Cienfuegos Pinar del Río Botanical Garden / Pinar del Río Camagüey Botanical Garden / Camagüey	<i>Syderoxylon obovatum</i> <sup>2</sup>	El Nicho Fruit Farm, Ministry of Agriculture / Cienfuegos Jovellanos fruit farm, owned by Héctor Correa / Matanzas

<sup>1</sup> Accepted name is indicated.<sup>2</sup> Collection was sent for food production projects.<sup>3</sup> Material aimed ex situ conservation programs or enrichment of living collections of recipient.<sup>4</sup> Germplasm targeted forestry program of recipient.<sup>5</sup> Material was sent to develop plant ornamental initiatives.<sup>6</sup> Collection was utilized in plant medicinal or tannin production activities of recipient.<sup>7</sup> We believe that recipient received this material from BGC.



**Figure 16.** Species currently grown in the living collections of Cienfuegos Botanical Garden that were collected during Utowana expedition. USDA accession number or provenance is indicated inside parenthesis. (A) *Averrhoa bilimbi* (St. Vincent Botanic Garden). (B) *Ochna mossambicensis* (98870). (C) *Eugenia grandis* (70785). (D) *Elaeis guineensis* (73009). (E) *Congea tomentosa* (Dominica Botanic Garden). (F) *Garcinia dulcis* (58589 or 68028). (G) *Lecythis tuyrana* (102609). (H) *Pterocarpus indicus* (Lancetilla Botanic Garden). See additional details of these accessions in Online Supplementary Table 1. Photo credits: Rosalina Montes Espín (A, D, E, F, H), Mario A. Lima Cruz (B, C, G).

der (1988), respectively. United States companies, such as United Fruit, operated in the Caribbean and had major influence in the politics of this area, particularly in Central America (Bucheli 2008).

The political and economic role played by the United States in the Caribbean also had consequences pertinent to the advancement of natural history studies in the Neotropics (McCook 2002). Biological and ecological research led by several US museums, universities, and research institutes had Caribbean ecosystem and organisms as pivotal topics for many of their scientific studies. As indicated by Raby (2017: 8–14) this research movement led to the establishment of several tropical biological stations in the region that were owned and operated by US institutions (e.g., Barro Colorado Island in Panama, Cinchona Botanical Station in Jamaica, El Verde in Puerto Rico). They followed a model that was in many aspects originally implemented by the European powers in their colonies, particularly in the 18<sup>th</sup> and 19<sup>th</sup> centuries (Plucknett et al. 1987: 41–58). Colonial botanic gardens created by these European countries facilitated oversea botanical surveys and economic botany enterprises (Plucknett et al. 1987: 46, 50; Drayton 2000: 190–196). Perhaps the best example comes from Kew Gardens which supervised an extensive network of tropical botanic gardens in Africa, Asia, and the West Indies, that was also followed by other European institutions (Drayton 2000: 251–255).

Our research has implications regarding understanding the dynamics of the three US-operated botanic gardens from the Caribbean. We show that the USDA and its *Utowana* expeditions facilitated the movement of plant collections among them. Therefore, this was an active network in which both a federal government agency and two different private organizations developed joint botanical initiatives. This collaboration resulted in having duplicate germplasm accessions of tropical plants that could not be grown in most of the United States mainland. During this period, the USDA had a station in Puerto Rico which is currently known as the Tropical Agriculture Research Station. It was founded in San Juan in 1901, but one year later it was moved to Mayagüez (McCook 2002: 66). This USDA facility mostly focused on experimental agriculture and this could explain why Mayagüez was not a target for *Utowana* expeditions. A full study regarding movements of germplasm between Puerto Rico and the continental US is out of the scope of this study; however, we cannot rule out that future studies will find that some of the *Utowana* collections also reached this USDA site located in Mayagüez. Still, it is a mystery why neither the *Utowana* nor David Fairchild visited Puerto Rico, a US unincor-

porated territory in which plant exploration logistics were certainly much easier than in most of the other Caribbean Islands.

Our study centered on CBG confirms results presented by Elton (2017) and Ibáñez (2017) regarding the important role played by David Fairchild and *Utowana* endeavors to facilitate the growing of the living collection of Summit Gardens in Panama. Preliminary studies focusing on Fairchild Tropical Botanic Garden (Miami) show that shortly after this garden was founded (in 1938, Zuckerman 1988), there were also frequent exchanges of plant material with the botanic gardens of Lancetilla, Cienfuegos, and Summit (Francisco-Ortega et al. unpublished).

Another implication of our research concerns how the expeditions of the *Utowana* led to interactions between the three US botanic gardens located in the Caribbean and those run by Britain, the Netherlands, and Spain that were situated in Africa, Asia, or the West Indies. Many samples that reached CBG through *Utowana* expeditions were collected in colonial botanical gardens that were operated by European countries, and located in the Old or New World.

#### CONCLUDING REMARKS

Through this study we have found evidence that supports the ramifications of USDA plant hunting expeditions beyond the germplasm repositories of this federal agency. These collections provided building blocks for plant breeders working with major crops; however, they also included exotic material with gardening, biological, or ethnobotanical value. USDA plant exploration activities were flexible and targeted cultivated sites, natural areas, markets, and botanic gardens. The *Utowana* collections that reached CBG and other Caribbean botanic gardens had a wide-ranging scope and they included plant material from different sources with different horticulture interests. Clearly CBG benefited from the *Utowana*'s collections; however, in our research we have shown that the material that reached Soledad had ramifications that involved other gardens from Cuba and the rest of the tropics.

#### ACKNOWLEDGEMENTS

We dedicate this publication to the memory of Prof. Angela Leiva (1948–2014), director of the National Botanic Garden of Cuba between 1972 and 2014, in recognition of a life devoted to the study and conservation of the flora of Cuba. Angela was an outstanding mentor,

scholar, friend, and colleague. Our gratitude to Charlotte Elton (Summit Gardens), Nancy Korber (Fairchild Tropical Botanic Garden) and Nichole Tiernan (Florida International University) for providing useful comments to the manuscript. Ramona Oviedo (Instituto de Sistemática y Ecología, Cuba) helped with the identification of plant material. We are grateful to Karen Williams (USDA National Germplasm Resources Laboratory) for locating for us Armour's (1931) report for the 1931 expedition of the Utowana to the Caribbean Islands, Central America, and Mexico. Diane Wunsch (USDA National Agricultural Library Special Collections) helped with the bibliographic and archival searches. Michael S. Dosmann and Lisa Pearson (Arnold Arboretum); Nancy Janda, Scarlett Townsend, and Justin Williams (Hunt Institute for Botanical Documentation); Robert Young (Museum of Comparative Zoology, Harvard University); and Gretchen Wade (Herbarium Library of Harvard University) kindly facilitated copies of botanists' portraits and relevant documents and images. Our gratitude also to the Archive and Library of Fairchild Tropical Botanic Garden for access to its archive collections. This contribution was largely based on a public lecture (<https://www.youtube.com/watch?v=yHFrtmaTpzYn>) jointly organized by the following three units of Florida International University: Cuban Research Institute, Kimberly Green Latin American and Caribbean Center, and Institute of the Environment. This lecture was presented through the internet (Zoom platform) on February 24, 2021 and had Catherine Mas (Florida International University) as the Discussant.

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**Online Supplementary Table at <https://oaj.fupress.net/index.php/webbia/article/view/10929/10167>**