



Taxonomy and systematics

## Checklist of the native vascular plants of Mexico

*Catálogo de las plantas vasculares nativas de México*

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Received 7 March 2016; accepted 6 May 2016

Available online 4 August 2016

### Abstract

An updated inventory of the native vascular plants of Mexico records 23,314 species, distributed in 2,854 genera, 297 families, and 73 orders. The flora includes 1,039 species of ferns and lycophytes, 149 gymnosperms, and 22,126 angiosperms. On average, the number of synonyms per species is 1.3 (mode = 1). The number of species places Mexico as the country with the fourth largest floristic richness in the world, although among the non-insular countries, by its number of endemic species (about 50%) is second only surpassed by South Africa. The species distribution among higher taxonomic categories, and the richness and endemism values in the 32 states of Mexico are discussed. This compilation allows us to assess the flora's contribution to the overall Mexican biodiversity.

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**Keywords:** Biodiversity; Biomes; Endemism; Flora of Mexico; Floristic studies; Inventories

### Resumen

Un inventario actualizado de plantas vasculares nativas de México registra 23,314 especies, distribuidas en 2,854 géneros, 297 familias y 73 órdenes. La flora incluye 1,039 especies de helechos y licofitas, 149 gimnospermas y 22,126 angiospermas. En promedio se registran 1.3 sinónimos por cada nombre aceptado (moda = 1). Por su número de especies, México ocupa el cuarto lugar a nivel mundial; entre los países continentales ocupa el segundo por el número de especies endémicas (alrededor del 50%), sólo por debajo de Sudáfrica. Se discute la distribución taxonómica de las especies entre las distintas categorías taxonómicas superiores, así como los valores de riqueza y endemismo entre los 32 estados del país. Esta recopilación permite evaluar la contribución de la flora a la biodiversidad de México.

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**Palabras clave:** Biodiversidad; Biomas; Endemismo; Flora de México; Estudios florísticos; Inventarios

### Introduction

The concept of biodiversity, applied to floristic richness, considers the number of taxa (categories of the taxonomic hierarchy) present in any geographical or administrative unit, such as county, state or country. With this number, it is possible to quantitatively evaluate diversity and compare it among areas. There are international agreements that prioritize the quantification

of biodiversity of the signatory countries, especially those with poor or insufficient knowledge of biodiversity at the national and/or regional levels, as is the case of Mexico (Conabio, 2012).

Mexico has a long and growing tradition of studying its vascular flora, reflected in the significant increase in recent decades of specimens housed in national scientific collections and abroad, backed by an immense bibliography. However, the knowledge of national floristic richness is still unsatisfactory mainly due to the difficulty of synthesizing scattered information in such publications along with the lack of well-curated databases of specimens documenting this richness. It is also clear that most genera require additional taxonomic study (revisions

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Peer Review under the responsibility of Universidad Nacional Autónoma de México.

or monographs), and large areas of land remain unexplored to date.

The first estimates of the vascular flora of Mexico, proposed more than 2 decades ago, quoted between 17,000 and 30,000 species (reviewed in Villaseñor, 2003). A decade ago, an extensive literature review led to an estimate of about 22,351 species of vascular plants (Villaseñor, 2003, 2004). Later, Llorente-Bousquets and Ocegueda (2008), collaborating with many specialists, published the first list of species of vascular plants of Mexico, which included 22,332 species, a figure remarkably similar to that reported by Villaseñor (2003). Their list was the first publication that documents in detail aspects of Mexican plant biodiversity (Conabio, 2008). Unfortunately, the exercise carried out by the Conabio (the Mexican Biodiversity Commission) has been little used, probably because the general public has limited access to such information, and the databases still have little impact on the presentation and management of biological information. Moreover, due to the dynamism of taxonomy, published scientific names are constantly changed due to updates and corrections, or added in publication of numerous new species. Therefore, the documented information on Mexico's floristic richness should be regularly updated through the publication of floristic lists or catalogs that synthesize information on the species reported.

A catalog (floristic list or checklist) represents a more or less critical summary of the information gathered or known about the plant species (or other taxonomic designation) of a region (Nimis, 1996), and it may vary in content or approach. Sometimes, as in this work, they only list the scientific names collected for the country; on other occasions they provide additional information, such as representative specimens, literature for particular taxonomic groups, synonymy, or specific comments aimed to clarify doubts or taxonomic conflicts (see, for example, Dávila et al., 2006; García-Mendoza & Meave, 2011; Guzmán, Arias, & Dávila, 2003; Ibarra-Manríquez, Villaseñor, & Durán, 1995; Villaseñor, Ortiz, Beutelspacher, & Gómez-López, 2013). Usually, a basic species list is what is first published for any region, so it always requires a critical evaluation. The reliability of the existing literature is an issue for any catalog and unreliable primary sources result in biases or difficulties in compiling lists; in addition, it is practically impossible to verify all species identifications, and the number of reviews or monographs consulted or available is relatively low. A further problem is the use of different taxonomic criteria; specialists do not always coincide in the circumscription of species, genera or even taxonomic categories of higher rank, and reconciling these different treatments is not trivial. Sometimes an inventory follows one of these criteria, while another may prefer an alternative approach. Expert opinions help clarify uncertainties, especially when the geographical distribution of species reveals errors of reference in a given regional inventory. Ultimately, it is up to catalog users to judge the reliability of names and additional information presented.

Many people are skeptical of the scientific value of catalogs, especially scholars of biodiversity that require information that catalogs do not provide directly. However, among the merits of catalogs is that they synthesize a wealth of information

accumulated throughout the history of botany and exploration of any territory. Listing species names is key to accessing a world of additional information on species, including aspects of natural history and current and potential uses. For taxonomists, lists are certainly valuable in order to consider the number of species to study in a review or monograph, and facilitate the inclusion of many species that have been overlooked in previous treatments. For ecologists and phytogeographers, catalogs are the first step to forming an informed opinion on the relationships between certain floras, and attempting to explain the causes, origins and evolution of diversity.

The aim of this contribution is to provide an updated catalog of the native vascular plant species of Mexico. This catalog is expected to serve as a basis for a better understanding of the Mexican flora and to promote more comprehensive floristic and taxonomic studies of groups or regions that require more detailed inventory or systematic work. As Nimis (1996) points out, catalogs are catalysts for new research projects and questions, and their relevance is not limited to floristic or taxonomic studies. The intention of this list of species was 2-fold: first, to document the current state of floristic knowledge, and second, to provide a basic reference that specialists can use to compare their data and more efficiently perform future taxonomic reviews. By examining the information provided here, it will soon be possible to handle more precise information on the floristic richness of the country and progress toward the long-awaited goal of having a flora of Mexico.

## Materials and methods

The catalog is the result of the review of over 2,500 references covering different aspects of the flora of Mexico. Among them are the numerous fascicles published by different regional taxonomic treatments for the country. They include, for example, Flora of El Bajío and adjacent regions (>190 fascicles and >30 additional fascicles), Flora of Veracruz (>150), Flora of the Tehuacán-Cuicatlán Valley (>130), Flora of Guerrero (>60), Flora of Jalisco (>20), Flora Mesoamericana (5 volumes) and Flora Novo-Galiciana (17 volumes). The protologues of many species that had never been mentioned in previous inventories or floristic treatments were also consulted. For example, in the last decade (2006–2015) 924 brand new species occurring in Mexico have been described, and 656 species have undergone name changes due to the proposal of new taxonomic combinations. Very few of these 1,580 names had been mentioned in publications of inventories or vegetation studies, and their inclusion in the catalog derives directly from the publications where they were originally described.

The compilation of this catalog has also benefited from the large body of published state and regional inventories published. In his 2 early-century reviews, Villaseñor (2003, 2004) reported the major contributions of these publications to the flora of Mexico, and pointed out the 13 states lacking statewide inventories at the time. Interestingly, updated floristic lists have been published for 5 of them since (Ciudad de México – formerly known as Distrito Federal [Rivera-Hernández & Flores-Hernández, 2013]; Jalisco [Ramírez-Delgado et al.,

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