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Chromosome numbers in *Verbesina* (Asteraceae, Heliantheae, Verbesininae)

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Abstract: We report chromosome counts for 107 samples of *Verbesina* collected in Ecuador, Mexico, and Venezuela. These counts represent 77 species with 47 of these belonging to species never counted before. Most samples have the hypothesized diploid number for the genus of $2n = 34$; a few taxa have $2n = 36$; 19 collections are polyploid. Polyploidy was found in a majority of the South American samples counted (13/23); polyploidy was not broadly distributed in samples counted for Mexican species (6/84). We report the first octoploid for a collection of *Verbesina, V. pedunculosa* from northcentral Mexico at n $(4x) = 68$. Previously published counts for *Verbesina* amount to 175 records representing 90 species. Together with the counts we report here, chromosome numbers are now known for 137 species of *Verbesina*.

Introduction

Polyploidy or whole genome duplication is broadly distributed in plants (Leebens-Mack et al., 2019) and is a source of genomic variation that can contribute to species diversification (Levin 1983; Otto, 2007; Barker et al., 2016a; Soltis et al. 2016). Most Asteraceae are paleohexaploid and share with their sister family Calyceraceae a paleotetraploid ancestor (Barker et al., 2016b). However, diploidization and subsequent polyploidization events have occurred multiple times in the evolution of the Asteraceae (Panero & Crozier, 2016). For example, all taxa of the Heliantheae alliance except Helenieae share a whole genome duplication (Leebens-Mack et al., 2019) but all members of the alliance have a hypothesized base chromosome number of $x = 19$ (Smith, 1975; Robinson et al., 1981a). Here, we explore the distribution of polyploidy in *Verbesina* using chromosome numbers.

With more than 325 species, *Verbesina* is the largest genus of tribe Heliantheae (Panero, 2007). Most species occur in Mexico, the tropical Andes, and eastern Brazil with a few taxa in the temperate regions of North America, South America, and the Caribbean. The genus is very diverse in habit. Some species are trees in montane moist or cloud forests but a majority of the species are shrubs in various montane tropical vegetation assemblages. Perennial herbs and a few annuals are common in the Caribbean and the hardwood forests of the eastern USA but the greatest diversity of these herbaceous species is found in the xerophytic shrublands and grasslands of northern Mexico and the southwestern USA. The capitula in *Verbesina* can be discoid or radiate and the corolla colors are mostly golden yellow or white; few species have red, orange, green, cream-colored, or light yellow, rarely pink, corollas. *Verbesina* can be easily separated from other Verbesininae and Heliantheae by its biconvex fruits with mostly symmetrical wings and a pappus of two awns without intervening squamellae.

Verbesina does not have a comprehensive revision. Robinson and Greenman (1899) divided the genus into 12 sections based mostly on capitulum size, habit, and corolla color. Since then, revisions of various sections have been published: *Lipactinia* (Blake, 1925), *Pterophyton*, *Sonoricola,* and *Ximenesia* (Coleman, 1964, 1966a, 1966b), *Pseudomontanoa* (Turner, 1985), and *Ochractinia*, *Platypteris,* and *Verbesina* (Olsen, 1985, 1986, 1988).

Results from molecular studies show that most of these sections are not monophyletic (Panero and Jansen, 1997) and echo commentary by Robinson and Greenman (1899), who considered some of their sections in their synopsis of *Verbesina* not natural. The same molecular results show that for the most part, leaf phyllotaxy is a good indicator of evolutionary history with opposite-leaved species more closely related to each other than to species with alternate leaves (Panero and Jansen, 1997).

Molecular phylogenetic studies of the chloroplast DNA show *Verbesina* is closely related to *Podachaenium* and *Squamopappus* in a clade sister to *Tetrachyron* (Panero and Jansen, 1997). This result was used by Panero (2007) to remove *Podachaenium*, *Squamopappus,* and *Verbesina* from subtribe Ecliptinae (sensu Robinson, 1981a) and amend the concept of subtribe Verbesininae to include only these three genera and *Tetrachyron*, the latter of which was previously classified in subtribe Neurolaeninae. Molecular studies using transcriptomic data of the nuclear DNA indicate that *Verbesina* is sister to the Engelmanniinae but this relationship is not strongly supported (Zhang et al., 2021). All chromosome numbers for *Verbesina* to date show that the genus has a base number of $x = 17$ or 18 with some tetraploid species (Robinson et al., 1981b; Jansen et al., 1984; Carr et al., 1999) and two records for taxa with higher ploidy levels (Jansen et al., 1984; Strother, 1976). *Podachaenium* and *Squamopappus* have a base chromosome number of $x = 19$ (Panero, 2007), whereas *Tetrachyron* has species with $2n = 30$, 32, and 34 (Strother & Panero, 2001).

Herein, we review all chromosome numbers available in the literature for *Verbesina* and report chromosome numbers for 107 collections of *Verbesina* gathered by the first author between 1992-1996 in Ecuador, Mexico, and Venezuela.

Materials and Methods

Capitula were fixed in the field in a 3:1 solution of ethanol and acetic acid. Large capitula were split in half to allow the fixative to reach inner parts of the inflorescence. All preserved capitula were collected shortly after the capitulescence started to develop. Anthers were excised from flowers and pollen parent cells were squeezed out of anther thecae. Hoyer's solution and acetocarmine stain were used to preserve cells and stain chromosomes.

Previously published chromosome counts for *Verbesina* were obtained from the index to chromosome numbers of Asteraceae webpage (http://www.lib.kobe-u.ac.jp/infolib/meta_pub/G0000003asteraceae_e) and downloaded on April 9, 2021.

Results and Discussion

We counted chromosome numbers for 107 collections of *Verbesina* with 47 of these counts corresponding to species that have not been counted before. Chromosome counts reported in the literature amounted to 175 records representing 90 species. Including the first counts we report here, 137 of the approximately 325 species of the genus now have chromosome number counts.

Most of the species counted were diploid at $2n = 34$; two species, *V. potosina* and *V. sericea,* were $2n = 36$. Tetraploids, although found in some species growing in Mexico, Ecuador, and Venezuela, were more commonly represented in South American species. Only six of the 84 Mexican collections that we counted were polyploid versus 13 of the 23 South American collections. Our three collections of the Mexican species *V. longipes* represented polyploid individuals of which one was hexaploid. Hexaploids are rare in the genus and have been reported only twice previously (Jansen et al., 1984; Strother, 1976). Here we report the first octoploid count for any species of *Verbesina* (observed in an individual of *V. pedunculosa* from Zacatecas, Mexico). Three North American species, *V. crocata*, *V. sericea* and *V. tetraptera* have individuals with either $n = 17$ or $n = 18$ corresponding to the two base chromosome numbers for the genus. *Verbesina callilepis*, *V. laevis* and *V. potosina* have

only counts of $n = 18$. An interesting result is that *Verbesina barclayae* from central Ecuador has counts of $2n = 66$ (one count with fragments), a count not recorded in any other species of the genus.

Below we provide a list of all the species counted for chromosome numbers in the genus with citations where the counts were previously published. For the most part counts are reported as in the original publications.

Chromosome counts in bold are new counts reported in this study. An exclamation mark (!) before a species name indicates a first count for the species. We include the state and country for our collections and country for vouchers used in previous studies.

Verbesina abscondita Klatt. **2*n* = 17 II**, *Panero 2506* (TEX) from a plant collected in Oaxaca, Mexico. Turner and King (1964), Mexico.

Verbesina alternifolia (L.) Britton. $n = 34$, Coleman, 1968; Heiser & Smith, 1955; Parfitt, 1981; Solbrig et al., 1972. All vouchers were collected in the U.S.A.

Verbesina apleura S. F. Blake. $n = 17$, Robinson et al. (1981), Guatemala.

!*Verbesina arborea* Kunth. **2*n* = 34 II**, *Panero 2999* (TEX), Pichincha, Ecuador; **2*n* = 34 II + 0-2 fragments**, *Panero 3025* (QCA), Imbabura, Ecuador.

Verbesina aristata (Ell.) A. A. Heller. $n = 17$, Coleman (1968, 1971, 1974), U.S.A.

Verbesina ayabacensis Sagast. **2*n* = ca. 32 II**, *Panero 2965* (TEX), from a specimen collected in Loja, Ecuador. Robinson & Panero (2006), reported $n = 34$.

Verbesina badilloi Panero. **2*n* = 17 II + 0-7 fragments**, *Panero 2685* (TEX) from a specimen collected in Mérida, Venezuela. $n = 17$, Panero et al. (1993).

!*Verbesina barclayae* H. Rob. **2*n* = 33 II + 0-2** fragments, *Panero 2954* (QCA); **2*n* = 33 II**, *Panero 2943* (TEX). Both collections were gathered in Azuay, Ecuador.

Verbesina barragana Cuatr. $n = 34$, Jansen et al. (1984), Colombia.

Verbesina bipinnatifida Baker in Martius. $n = 17$, Lopes Moreira and Barbosa Cavalcanti (2020), Brazil.

Verbesina boliviana Klatt. $n = 17$, Robinson et al. (1981), Bolivia.

!*Verbesina brachypoda* S. F. Blake. **2*n* = 34 II**, *Panero 2920* (TEX), Chimborazo, Ecuador; *Panero 2925* (QCA), Cañar, Ecuador.

Verbesina callilepis S. F. Blake. $n = 18$, De Jong & Longpre (1963), Mexico.

!*Verbesina caracasana* B. L. Rob. & Greenm. **2*n* = 34 II**, *Panero 2623* (TEX), Carabobo, Venezuela; *Panero 2636* (TEX), Portuguesa, Venezuela.

Verbesina chapmanii J. R. Coleman. $2n = 34$, Coleman 1974; Strother (2016), Mexico.

!*Verbesina chilapana* B. L. Turner. **2*n* = 17 II + 1 f**, *Panero 2037* (TEX). This specimen was collected in southern Mexico in the state of Guerrero.

Verbesina clausenii L. $n = 17$, Watanabe et al. (2007), Brazil.

!*Verbesina corral-diazii* B. L. Turner. **2*n* = 17 II**, *Panero 2241* (TEX). This specimen was collected in northwestern Durango state, Mexico.

Verbesina costata Fay. $2n = 17$ II, Sundberg et al. (1986), Mexico.

Verbesina crassicaulis S. F. Blake. $n = 17$, Jansen et al. (1984), Colombia.

!*Verbesina crassipes* B. L. Rob. & Greenm. **2*n* = 17 II**, *Panero 2473* (TEX), Oaxaca, Mexico.

Verbesina crocata (Cav.) Less. **2*n* = 17 II**, *Panero 2445* (TEX); **2*n* = 17 II + 0-1 f**, *Panero 2446* (TEX). $2n = 34$, Keil & Stuessy, (1977); $2n = 36$, Turner et al. (1961), Turner et al. (1962). Collections for our counts were gathered in Guerrero, Mexico; published counts based on collections gathered in Mexico.

Verbesina cronquistii B. L. Turner. $2n = 34$, Turner (1985), Mexico.

!*Verbesina curatella* McVaugh. **2*n* = 17 II**, *Panero 2857* (TEX), Jalisco, Mexico.

!*Verbesina cymbipalea* S. F. Blake. **2*n* = 17 II + 1 fragment**, *Panero 2210* (TEX), Durango, Mexico.

!*Verbesina dissita* A. Gray. **2*n* = 17 II**, *Panero 2802* (TEX), Baja California, Mexico.

Verbesina eggersii Hieron. **2*n* = 17 II**, *Panero 2985* (TEX), El Oro, Ecuador; $2n = 34$, Robinson et al. (1981b).

Verbesina elegans Kunth. $n = 51 + 11$ f, Jansen et al. (1984), Colombia.

Verbesina encelioides (Cav.) Benth. & Hook. f. ex A. Gray. **2*n* = 17 II**, *Panero 2171* (TEX), Coahuila, Mexico. $2n = 34$, Badr et al. (1997); Carlquist (1954); Carr et al. (1999); Coleman (1968); Covas & Schnack (1946); DeJong & Longpre (1963); Dematteis et al. (2007); Gupta & Hill (1983); Gupta and Hill (1989); Jose & Mathew (1995); Hunziker et al. (1990); Keil & Stuessy (1977); Keil et al. (1988); Morton (1981); Oberprieler & Vogt (1993); Pinkava & Keil (1977); Powell & Powell (1977a, 1977b); Robinson et al. (1981b); Solbrig et al. (1972); Strother & Panero (2001); Turner & Ellison (1960); Turner et al., (1979); Ward (1983); Weedin & Powell (1980). The most counted species in the genus and invariably $2n = 34$. The species has been introduced to many tropical and subtropical regions of the world. Previously published chromosome counts from collections gathered in Argentina, Bolivia, Dominican Republic, Egypt, India, Mexico, Morocco, and U.S.A.

Verbesina fastigiata B. L. Rob. & Greenm. **2*n* = 17 + 0-1 f**, *Panero 2423* (TEX), Michoacán, Mexico. $2n = 34$, Solbrig et al. (1972); Strother (1983); Sundberg et al. (1986); Turner & King (1964, as *V. greenmanii*); Turner (1985). Previously published chromosome counts from collections gathered in Mexico.

!*Verbesina fayi* B. L. Turner. **2*n* = 17 II**, *Panero 2483* (TEX), Oaxaca, Mexico.

Verbesina gigantea Jacq. $2n = 34$, Powell & King (1969), Dominican Republic; Robinson et al. (1981b), Guatemala.

!*Verbesina glaucophylla* S. F. Blake. **2*n* = 17 II**, *Panero 2865* (TEX), Jalisco, Mexico.

Verbesina glabrata Hook. & Arn. $2n = 34$, Coleman (1968), Brazil; $2n = 68$, Robinson et al. (1981b), Bolivia.

!*Verbesina gracilipes* B. L. Rob. **2*n* = 17 II + 2 f**, *Panero 2592* (TEX), Puebla, Mexico.

!*Verbesina grayi* (Sch.-Bip.) Benth. & Hook. f. ex Hemsl. **2*n* = 17 II**, *Panero 2779* (TEX), Durango, Mexico; *Panero 2889* (TEX), Jalisco, Mexico.

!*Verbesina guatemalensis* B. L. Rob. & Greenm. **2*n* = 17 II**, *Panero s. n.* (TEX), Chiapas, Mexico.

Verbesina helianthoides Michx. $2n = 34$, Heiser & Smith (1955); Coleman (1971); Keil & Stuessy (1977). All collections were gathered in the U.S.A.

Verbesina heterophylla (Chapman (A. Gray). $2n = 34$, Coleman (1971, 1974), U.S.A.

!*Verbesina hidalgoana* B. L. Turner. **2*n* = 17 II**, *Panero 2552* (TEX), Hidalgo, Mexico.

Verbesina humboldtii Spreng. $n = 17$, Jansen et al. (1984), Colombia.

Verbesina hygrophila Panero & Villaseñor. **2*n* = 17 II + 2-3 f**, *Panero 2253* (TEX), Durango, Mexico; Panero et al. (1993).

Verbesina hypargyrea B. L. Rob. & Greenm. **2*n* = 17 II**, *Panero 2521* (TEX), Chiapas, Mexico. $2n = 34$, Turner et al. (1962).

Verbesina hypoglauca Sch. Bip. **2*n* = 17 II**, *Panero 2478*, **2*n* = 17 II + 0-1 f**, *Panero 2550* (TEX), Oaxaca, Mexico. $2n = 17$ II, Powell et al. (1977); Sundberg et al. (1986). $n = 17$ II + 1 f, Strother (1983). Previously published chromosome counts based on collections gathered in Mexico.

Verbesina hypomalaca B. L. Rob. & Greenm. $n = 16$, Turner et al., (1961). $n = 17$ II, Strother (1976). *Verbesina hypomalaca* var. *saltillensis*, $n = 17$, Turner (1982). All counts based on collections gathered in Mexico.

!*Verbesina jacksonii* B. L. Turner. **2*n* = 17 II**, *Panero 2197* (TEX), Durango, Mexico.

!*Verbesina juxtlahuacensis* Panero & Villaseor. **2*n* = 17 II**, *Panero 3531* (TEX), Oaxaca, Mexico.

Verbesina laevis S. F. Blake. $2n = 36$ II, Carr et al. (1999), Peru.

Verbesina lanata B. L. Rob. & Greenm. $2n = 17$ II, Strother (1983), Mexico, Olsen (1980), Colombia.

Verbesina latisquamata S. F. Blake. ca. $n = 34$, Robinson et al. (1981b), Ecuador; $2n = 34$ II, Carr et al. (1999), Ecuador.

!*Verbesina liebmannii* Sch. Bip. ex Klatt. **2*n* = 17 II**, *Panero 2479* (TEX), *Panero 2488*

(TEX), *Panero 2489* (TEX). All collections from Oaxaca, Mexico.

Verbesina lilloi S. F. Blake. $n = 34$, Rozenblum et al., (1985), Argentina.

Verbesina lindenii (Sch. Bip.) S. F. Blake. $n =$ 17, Coleman (1968), Robinson et al. (1981b), Turner et al. (1961), Urbatsch (1964). All collections from Mexico and Guatemala.

Verbesina lindheimeri B. L. Rob. & Greenm. $n = 17$, Urbatsch (1975), U.S.A.

!*Verbesina lloensis* Hieron. ex Sodiro. $\mathbf{2n} =$ **34 II**, *Panero 3010* (TEX), Pichincha, Ecuador.

Verbesina longifolia (A. Gray) A. Gray. $2n =$ **34 II +1-2 f, (some cells with 1 VI + 4 IV + 23 II + 1-2 f)**, *Panero 2199* (TEX), Durango, Mexico. $n = 17$, Coleman (1968); $2n = 17$ II, Pinkava & Keil (1977), U.S.A.

!*Verbesina longipes* Hemsl. $\mathbf{2n} =$ **34 II + 1-4 f**, *Panero 2181*; $\mathbf{2n} =$ **34 + 0-2 f**, *Panero 2182*; $\mathbf{2n} =$ **51 II**, *Panero 2361* (TEX). Both counts from specimens gathered in Coahuila, Mexico.

!*Verbesina lottiana* B. L. Turner & Olsen. $\mathbf{2n} =$ **17 II**, *Panero 2868* (TEX), Jalisco, Mexico.

Verbesina luetzelburgii Mattf. $2n = 34$, Lopes Moreira et al. (2020), Brazil.

!*Verbesina maldonadoensis* H. Rob. & Panero. $\mathbf{2n} =$ **ca. 34 II**, *Panero 3035* (TEX), Carchi, Ecuador.

Verbesina mexicana Cerv. ex DC. $2n = 34$, Zhao (1996), Mexico.

Verbesina microptera DC. $\mathbf{2n} =$ **17 II + 0-1 f**, *Panero 2343* (TEX), Nuevo León, Mexico. $2n = 34$, Turner (1966); Weedin & Powell (1977), Olsen (1979), Zhao & Turner (1993). Previously published chromosome counts based on collections gathered in Mexico and U.S.A.

Verbesina minuticeps S. F. Blake. $n = 17 + 1$ f, Robinson et al. (1981b), Ecuador.

Verbesina montanoifolia B. L. Rob. & Greenm. $\mathbf{2n} =$ **17 II + 2 f**, *Panero 2425* (TEX), Michoacán, Mexico; $\mathbf{2n} =$ **17 II + 1 f**, *Panero 2415*, (TEX), Michoacán, Mexico. $n = 17$, Fay (1974), Turner (1985), Mexico.

!*Verbesina myriocephala* Sch. Bip. ex Klatt. $\mathbf{2n} =$ **17 II + 0-1 f**, *Panero 2656* (TEX), Trujillo, Venezuela.

Verbesina nana (A. Gray) B. L. Rob. & Greenm. $2n =$ ca. 34, Watson (1973), U.S.A.

!*Verbesina negrensis* Steyerm. $\mathbf{2n} =$ **17 II + 2 f**, *Panero 2703* (TEX), Táchira, Venezuela.

Verbesina nelidae Cabrera. $n = 34$, Rozenblum et al. (1985), Argentina.

!*Verbesina nelsonii* B. L. Rob. & Greenm. $\mathbf{2n} =$ **17 II**, *Panero 2463* (TEX); $\mathbf{2n} =$ **17 II + 2 f**, *Panero 2459* (TEX). The two collections gathered along the Chilapa-Tlapa highway in central Guerrero, Mexico.

!*Verbesina neotenoriensis* B. L. Turner. $\mathbf{2n} =$ **17 II + 1 f**, *Panero 2310* (TEX), Puebla, Mexico.

Verbesina neriifolia Hemsl. $\mathbf{2n} =$ **17 II**, *Panero 2517* (TEX), Chiapas, Mexico. $n =$ ca. 17, Solbrig et al. (1972), Mexico.

Verbesina occidentalis (L.) Walter. $n = 17$, Heiser & Smith (1955), Coleman (1968), U.S.A.

Verbesina oerstediana Benth. $n =$ ca. 17; $n =$ 15-17, Robinson et al. (1981b), Costa Rica.

Verbesina oligactis S. F. Blake. $n = 17$, Olsen (1980), Colombia.

Verbesina oligocephala I. M. Johnst. $n = 17 +$ 1-2 B, Coleman (1966), $n = 17$, Coleman (1968), Mexico.

Verbesina olsenii B. L. Turner. $\mathbf{2n} =$ **17 II**, *Panero 2156* (TEX), Nuevo León, Mexico. $2n = 34$, Turner (1985), Mexico.

Verbesina oncophora B. L. Rob. & Greenm. $n =$ ca. 17, Solbrig et al (1972), Mexico.

Verbesina oreopola B. L. Rob. & Greenm. $n =$ 17 + 5 f, Jansen & Stuessy (1980), Mexico.

Verbesina ovatifolia A. Gray. $\mathbf{2n} =$ **17 II**, *Panero 3096* (TEX), Chiapas, Mexico. $2n = 17$ II + 1 B, Sundberg et al. (1986), Mexico, $2n + 17$ II, Carr et al. (1999), Costa Rica.

Verbesina pallens Benth. $n = 17$, Solbrig et al. (1972), Nicaragua.

!*Verbesina pantoptera* S. F. Blake. $\boldsymbol{n} =$ **17 each pole in dyads**, *Panero 2194* (TEX), Zacatecas, Mexico.

Verbsina papasquiara Panero & Villaseñor. **2*n* = 17 II**, *Panero 2264* (TEX), Durango, Mexico. *n* = 17, Panero et al. (1993).

Verbesina parviflora (Kunth) S. F. Blake. **2*n* = 17 II**, *Panero 2180* (TEX), Nuevo León, Mexico; **2*n* = 17 II**, *Panero 2204* (TEX), Durango, Mexico.

!*Verbesina pauciflora* Small. **2*n* = 17 II**, *Panero 2571* (TEX), Sinaloa, Mexico.

!*Verbesina pedunculosa* B. L. Rob. ***n* = 17 each pole in dyads**, *Panero 2195* (TEX); **2*n* = 68 II (some cells with 66 II + 1 IV)**, *Panero 2224* (TEX). *Panero 2224* is an octoploid individual collected in Zacatecas, Mexico, and represents the highest ploidy level recorded for *Verbesina*.

Verbesina pellucida Panero & Villaseñor. **2*n* = 17 II**, *Panero 2746* (TEX), Oaxaca, Mexico. *n* = 17, Villaseñor & Panero (1993).

Verbesina peninsularis S. F. Blake. *n* = 17, Coleman (1966), Mexico.

Verbesina pennellii S. F. Blake. *n* = 34, Jansen et al. (1984), Colombia.

Verbesina pentantha S. F. Blake. **2*n* = ca. 32 II**, *Panero 2960* (QCA), Loja, Ecuador. *n* = 34, Robinson et al. (1981b), Ecuador.

!*Verbesina peraffinis* S. F. Blake. **2*n* = 17 II**, *Panero 2624* (MY), Cojedes, Venezuela.

Verbesina persicifolia DC. **2*n* = 17 II + 3-6 f**, *Panero 2235* TEX), San Luis Potosí, Mexico; **2*n* = 17 II + 0-1 f**, *Panero 2351* (TEX), Nuevo León, Mexico. 2*n* = 17 II, Strother (1983), Mexico.

Verbesina perymenioides Sch. Bip. ex Klatt. **2*n* = 17 II**, *Panero 2527* (TEX) Chiapas, Mexico. *n* = 17, Solbrig et al., (1972), Mexico, 2*n* = 17 II, Strother (1983), Mexico.

!*Verbesina petrophila* Brandegee. **2*n* = 17 II**, *Panero 2597* (TEX), Puebla, Mexico.

!*Verbesina pietatis* McVaugh. **2*n* = 17 II**, *Panero 2426* (TEX), Michoacán, Mexico.

!*Verbesina platyptera* Sch. Bip. ex Klatt. **2*n* = 17 II**, *Panero 3637* (TEX), Colima, Mexico.

Verbesina pleistocephala (J. D. Smith) B. L. Rob. 2*n* = 17 II, Strother (1983), Mexico.

!*Verbesina potosina* B. L. Rob. **2*n* = 18 II + 0-1 f**, *Panero 2375* (TEX), San Luis Potosí, Mexico.

!*Verbesina pterocarpha* S. F. Blake. **2*n* = 17 II**, *Panero 2556* (TEX), Michoacán, Mexico.

!*Verbesina pterocaula* (Moc. & Sessé) DC. **2*n* = 17 II**, *Panero 2291* (TEX), Guerrero, Mexico.

!*Verbesina punctata* B. L. Rob. & Greenm. **2n = 17 II**, *Panero 2124* (TEX), Chiapas, Mexico.

Verbesina purpusii Brandegee. *n* = 17, 2*n* = 17 II + 2 B, Sundberg et al. (1986), Mexico.

!*Verbesina resinosa* Klatt. **2*n* = 17 II**, *Panero 2455* (TEX), Guerrero, Mexico.

Verbesina rivettii Hieron. 2*n* = 34 II, Carr et al. (1999), Ecuador.

Verbesina robinsonii (Klatt) Fernald ex B. L. Rob. & Greenm. **2*n* = 17 II + 3 f**, *Panero 2302* (TEX), Hidalgo, Mexico; **2n = 17 II**, *Panero 2342* (TEX) San Luis Potosí, Mexico. 2*n* = 34, Zhao & Turner (1993), Mexico.

Verbesina rothrockii B. L. Rob. & Greenm. *n* = 17, Coleman (1968); 2*n* = ca. 88, Strother (1976). Strother (1976) states that his count based on a collection made in Mexico (*Strother 1113*, UC) has low pollen stainability (18%) and represents a pentaploid individual.

Verbesina saubinetioides S. F. Blake. *n* = 17, Diers (1961), Peru.

Verbesina seatonii S. Blake. *n* = 17, Turner et al. (1962), Mexico.

Verbesina seemannii Sch. Bip. *n* = 17, Turner & Flyr (1966), Mexico.

Verbesina semidecurrens Kuntze. *n* = 17, Robinson et al. (1981b), Bolivia, 2*n* = 17 II, Carr et al. (1999), Bolivia.

!Verbesina sericea Kunth & Buché. **2*n* = 18 II**, *Panero 2328* (TEX), Puebla, Mexico; **2*n* = 17 II**, *Panero 2499* (TEX), Oaxaca, Mexico.

Verbesina serrata Cav. *n* = 17, Turner et al. (1961), Coleman (1968). *Verbesina serrata* var. *amphichlora* B. L. Rob. & Greenm. *n* =17, Pinkava & Keil (1977). All collections were gathered in Mexico

!*Verbesina simulans* S. F. Blake. **2*n* = 17 II**, *Panero 2676* (TEX), Mérida, Venezuela.

Verbesina sodiroi Hieron. **2*n* = 34 II**, *Panero 2916* (TEX); Cañar, Ecuador; **2*n* = 34 II**, *Panero 3013* (QCA), Pichincha, Ecuador. *n* = 34, Robinson et al. (1981b); 2*n* = 34 II, Carr et al (1999), Ecuador.

Verbesina sororia A. Gray. **2*n* = 34 II + 1 f**, *Panero 2341* (TEX), San Luis Potosí, Mexico. *n* = 34, Turner & Flyr (1966), Mexico.

!*Verbesina sousae* J. J. Fay. **2*n* =17 II + 2-3 f**, *Panero 6227* (TEX), Chiapas, Mexico.

!*Verbesina sphaerocephala* A. Gray. **2*n* = 17 II**, *Panero 2420* (TEX), Michoacán, Mexico.

Verbesina stenophylla Greenm. *n* = ca. 17, Turner & Flyr (1966), Mexico.

Verbesina stricta A. Gray. *n* = 17, Turner et al. (1961), Mexico.

Verbesina strotheri Panero & Villaseñor. **2*n* = 17 II**, *Panero 2526* (TEX), Chiapas, Mexico. *n* = 17, Panero et al. (1993).

Verbesina subcordata DC. 2*n* = 34, Schnack & Covas (1947), Argentina, DeMatteis et al. (2007), Paraguay.

Verbesina sublobata Benth. 2*n* = 34, Solbrig et al. (1972), Costa Rica, Jansen & Stuessy (1980), Nicaragua, Carr et al. (1999), Costa Rica.

!*Verbesina synotis* S. F. Blake. **2*n* = 17 II**, *Panero 2371* (TEX), Chihuahua, Mexico.

Verbesina tequilana J. R. Coleman. **2*n* = 17 II + 10 f**, *Panero 2227* (TEX), Jalisco, Mexico. *n* = 17, Keil & Stuessy (1977), Mexico.

Verbesina tetraptera L. *n* = 17, Turner et al. (1961), Mexico. *n* = ca. 18, De Jong & Longpre (1963), Mexico.

Verbesina trilobata B. L. Rob. & Greenm. **2*n* = 17 II + 1-2 f**, *Panero 2334* (TEX); **2*n* = 17 II**, *Panero 2325* (TEX), both collections from Puebla, Mexico. 2*n* = 34, Turner (1985), Mexico.

!*Verbesina trujillensis* Aristeg. **2*n* = 17 II**, *Panero 2661* (MY); **2*n* + 17 II**, *Panero 2662* (MY). The two collections were gathered in the state of Trujillo, Venezuela.

Verbesina turbacensis Kunth. **2*n* = 17 II**, *Panero 2462* (TEX), Guerrero, Mexico; **2*n* = 17 + 2-5 f**, *Panero 2494* (TEX), Oaxaca, Mexico; **2n = 17 II**, *Panero 2536* (TEX), Chiapas, Mexico; **2*n* =17 II**, *Panero 2634* (TEX), Portuguesa, Venezuela. *n* = 17, Turner & King (1964), Solbrig et al. (1972), Robinson et al. (1981b). *n* = ca. 17, Robinson et al. (1981b). 2*n* = 17 II, Strother (1983). Published counts belong to specimens gathered across the range of the species in Costa Rica, Mexico, and Venezuela.

!*Verbesina vallartana* B. L. Turner. **2*n* = 17 II**, *Panero 2570* (TEX), Nayarit, Mexico.

Verbesina virgata Cav. **2*n* = 17 II + 3 f**, *Panero 2757* (TEX), Oaxaca, Mexico; **2*n* = 17 II**, *Panero 2250* (TEX), Durango, Mexico; 2*n* = 17 II, *Panero 2448* (TEX), Jalisco, Mexico; **2*n* = 17 II**, *Panero 2567* (TEX), Jalisco, Mexico; **2*n* = 17 II + 1 f**, *Panero 2303* (TEX), Hidalgo, Mexico; **2*n* = 17 II**, *Panero 2392* (TEX), Ciudad de México, Mexico. *n* = 17, Turner et al. (1961), Mexico, Soto-Trejo et al. (2011), Mexico.

Verbesina virginica L. *n* = 17, Coleman (1968), Jones (1970), Solbrig et al., (1972). All collections were gathered in the U.S.A.

Verbesina walteri L. *n* = 17, Coleman (1971), U.S.A.

Verbesina warei L. *n* = 17, Coleman (1968), U.S.A. *n* = ca. 17, Turner & Flyr (1966), U.S.A.

Verbesina zaragosana B. L. Turner. 2*n* = 34, Zhao (1996), Mexico.

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