

New Chromosome Numbers in *Helianthus* and Related Genera (Compositae)

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A detailed report on the chromosome numbers in the perennial species of *Helianthus* has never been published. Now that chromosome determinations are available for over one-half of the North American species of sunflowers it seems desirable to present an annotated list of the counts. All the new counts reported here were secured from microsporocytes smeared in acetocarmine. Voucher specimens are deposited in the herbarium of Indiana University.

Examination of Table 1 reveals that a polyploid series is present within the perennial sunflowers, with 17 species diploid, 4 tetraploid, and 7 hexaploid. It would seem that polyploidy is confined to the perennial species, for the six annuals previously reported are all diploid (3). To this list of annuals may be added *Helianthus agrestis* Pollard ($n=17$, Pinellas Co., Fla., *R. K. Godfrey* 50848), and *H. praetermissus* E. E. Wats. ($n=17$, Pecos Co., Texas, T. Odell [*Heiser* 5246]; $n=17$, Valencia Co., N. M., P. Weatherwax [*Heiser* 5245]). One annual species, *H. anomalus* Blake, still remains to be counted.

Perhaps the most difficult species from a taxonomic standpoint is *Helianthus strumosus*, which Watson (8) segregated into numerous "species." Certain of Watson's species are listed in Table 1 under *H. strumosus*. It is now apparent that *H. strumosus* comprises both tetraploid and hexaploid populations which may account for some of the taxonomic difficulties. A detailed cyto-taxonomic study of this group is now underway by the junior author.

Helianthus heterophyllus is reported as a diploid in Table 1, but material from other sources (Jackson Co., Miss., *Heiser* 4019 and Walton Co., Fla., *Heiser* 3223) shows a highly irregular meiosis with the presence of both univalents and trivalents. It seems probable that these plants are triploids.

In a previous note (4) it was stated that *Helianthus hirsutus* was diploid. The specimen upon which the count was based has now been determined as *H. divaricatus* and counts on *H. hirsutus* have shown it to be tetraploid. In this same paper *H. pumilus* was reported as diploid, but careful study of the herbarium material has shown that this specimen should probably be referred to *H. Nuttallii*.

1. This study was aided by grants from the National Science Foundation (N.S.F.-G18) and the American Philosophical Society (No. 1146).

TABLE 1

Chromosome numbers in the perennial species of *Helianthus*.

Species	n		Source and Specimen Number
	Chromo- some	Previous Report	
<i>H. atrorubens</i> L.	17		Louisa Co., Va., J. T. Baldwin, Jr., P45
	17		McDowell Co., N. C., Smith 1077
<i>H. californicus</i> DC.	51		Solano Co., Calif., Heiser 1972
	51		Napa Co., Calif., G. L. Stebbins & Heiser, P304
<i>H. carnosus</i> Small	17		Volusia Co., Fla., Heiser 3184
<i>H. ciliaris</i> DC.	51		St. Clair Co., Ill., Heiser 3097
<i>H. Cusickii</i> A. Gray	17		Yakima Co., Wash., A. T. Kruckeberg, P306
<i>H. decapetalus</i> L.	34		Monroe Co., Ind., Heiser 3005, 3017
	34		Monroe Co., Ind., Smith 1081
<i>H. divaricatus</i> L.	17		Brown Co., Ind., Heiser 3099
	17		Jay Co., Ind., Smith 1049
<i>H. giganteus</i> L.	17	(2)	
<i>H. gracilentus</i> A. Gray	17		Los Angeles Co., Calif., Heiser 1939
<i>H. grosseserratus</i> Martens	16	(1)	
	17	(2)	
	17		St. Louis Co., Mo., Heiser 1490
<i>H. heterophyllus</i> Nutt.	17		Okaloosa Co., Fla., Heiser 4023
<i>H. hirsutus</i> Raf.	34		LaGrange Co., Ind., C. C. Deam, P65
	34		McCreary Co., Ky., Smith, P132
<i>H. laetiflorus</i> Pers.	51		Cultivated, Heiser 3112
<i>H. laevigatus</i> T. & G.	34		Pendleton Co., W. Va., Smith 1065
<i>H. Maximiliani</i> Schrad.	17	(2)	
	17		Cass Co., N. D., O. A. Stevens, P28
<i>H. microcephalus</i> T. & G.	17	(2)	
	17		Brown Co., Ind., Heiser, P77
<i>H. mollis</i> Lam.	17		St. Louis, Mo., Heiser 1818
<i>H. niveus</i> (Benth.) T. S. Brandeg.	17		Yuma Co., Ariz., Smith, P193
	17		Puerto Kino, Sonora, Mex., R. Felger, P198
<i>H. Nuttallii</i> T. & G.	17		Wyoming, R. J. Davis, P47
<i>H. occidentalis</i> Riddell	17	(2)	
	17		Texas Co., Mo., Heiser 3095
<i>H. radula</i> (Pursh) T. & G.	17		Alachua Co., Fla., L. E. Arnold, P50
<i>H. rigidus</i> (Cass.) Desf.	51	(7)	
	51		Cass Co., N. D., O. A. Stevens, P29
	51		Lawrence Co., Ind., Heiser 3111
<i>H. salicifolius</i> A. Dietr.	17	(2)	
	17		Cultivated, Heiser, P115
<i>H. silphioides</i> Nutt.	17		Hickman Co., Ky., Deam, P61

Species	n Chromosome Number	Previous Report	Source and Specimen Number
<i>H. strumosus</i> L.	51 51	(7)	Greenville Co., S. C., Heiser, P140
<i>H. arenicola</i> E. E. Wats.	34		Dane Co., Wis., Heiser, P134
<i>H. chartaceus</i> E. E. Wats.	34		Tippecanoe Co., Ind., Smith 1022
<i>H. leoninus</i> E. E. Wats.	34		St. Clair Co., Ill., Heiser, P9
<i>H. montanus</i> E. E. Wats.	51		Blount Co., Tenn., Smith 1079
<i>H. virilis</i> E. E. Wats.	34		Greene Co., Ind., Smith, P298
<i>H. tomentosus</i> Michx.	51		Transylvania Co., N. C., W. C. Duncan 11960
	51		Wayne Co., Miss., Heiser 3236
<i>H. tuberosus</i> L.	51 51 51 51	(7)	St. Louis Co., Mo., Heiser, P5 Posey Co., Ind., Heiser, P126 Hennepin Co., Minn., G. Ownbey 1165

Chromosome counts were also obtained on a number of other members of the Heliantheae during the course of this investigation. (Table 2.) *Viguiera* appears to be the nearest relative of *Helianthus*; therefore, it is not surprising to find the number 17 in this genus. Of particular interest, however, is the presence of $n=8$ in *Viguiera multiflora*. It appears probable then that the number 17 in *Helianthus* and related genera may have been derived through allopolyploidy between an $n=8$ species and an $n=9$ species (as yet unknown). On this basis also it might be suggested that *Helianthus* may have been derived from *Viguiera*, although detailed study is necessary before definite conclusions can be reached.

TABLE 2

New chromosome numbers in miscellaneous species of the *Heliantheae*.

Species	n Chromosome Number	Source and Specimen Number
<i>Echinacea purpurea</i> Moench.	11	Cultivated, Heiser 3150
<i>Iva ciliata</i> Willd.	17	Posey Co., Ind., Heiser 7-8-51
<i>Phoebanthus grandiflora</i> (T. & G.) Blake	34	Sarasota Co., Fla., Heiser 3201
<i>Rudbeckia laciniata</i> L.	19	Cultivated, "Golden Glow," Heiser 3152
<i>Tithonia tubaeformis</i> (Jacq.) Cass.	17	Guerrero, Mexico, E. Hernandez X-3187
<i>Verbesina alternifolia</i> (L.) Britt.	34	Monroe Co., Ind., Heiser 3127
<i>V. helianthoides</i> Michx.	17	Franklin Co., Mo., Heiser 3149
<i>V. occidentalis</i> (L.) Walt.	17	Greenville Co., S. C., Heiser 3171
<i>Viguiera cordifolia</i> A. Gray	17	Pima Co., Ariz., Smith 1952
<i>V. multiflora</i> (Nutt.) Blake	8	Grant Co., Colo., D. & B. Norby 548
<i>Zexmenia frutescens</i> (Mill.) Blake	11	Turrialba, Costa Rica, Heiser 3342

Acknowledgements:

The counts for *Helianthus giganteus*, *H. grosseserratus*, *H. Maximiliani*, *H. Nuttallii*, and *H. salicifolius* have been verified by Dr. Robert Long (6), and those for *H. mollis* and *H. tomentosus* by Mr. Raymond Jackson (5). The count for *H. carnosus* was supplied by Miss Sarah Clevenger. Dr. William Weber has also counted $n=8$ in *Viguiera multiflora* (in litt.). It is also a pleasure to acknowledge the assistance of the many individuals listed in the table who supplied seeds or living material for study.

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