

GOLDEN HILLS RC&D presents
**NATIVE SUNFLOWER
IDENTIFICATION**



Online class via Zoom
Monday, January 25
7:00-8:00pm

Learn how to identify common flowers in the genus
Helianthus (sunflowers) with Dr. Tom Rosburg

Pre-registration required. \$5 registration fee. Learn more and sign up at

goldenhillsrcd.org/plantID

Open to the public. Project made possible through a grant from
Gilchrist Foundation



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Michigan Flora Online -- <https://michiganflora.net/home.aspx>

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Online Virtual Flora of Wisconsin -- <http://wisflora.herbarium.wisc.edu/index.php>

Dr. Thomas Rosburg (border lines)

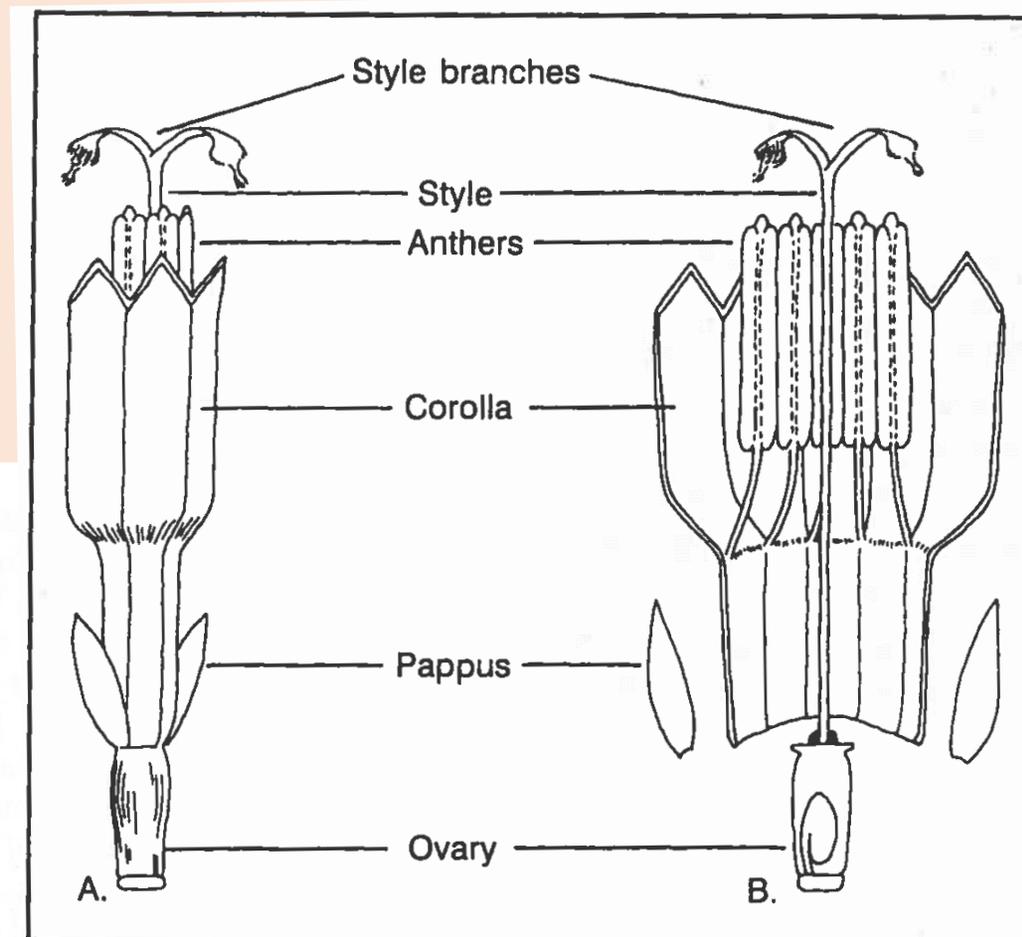
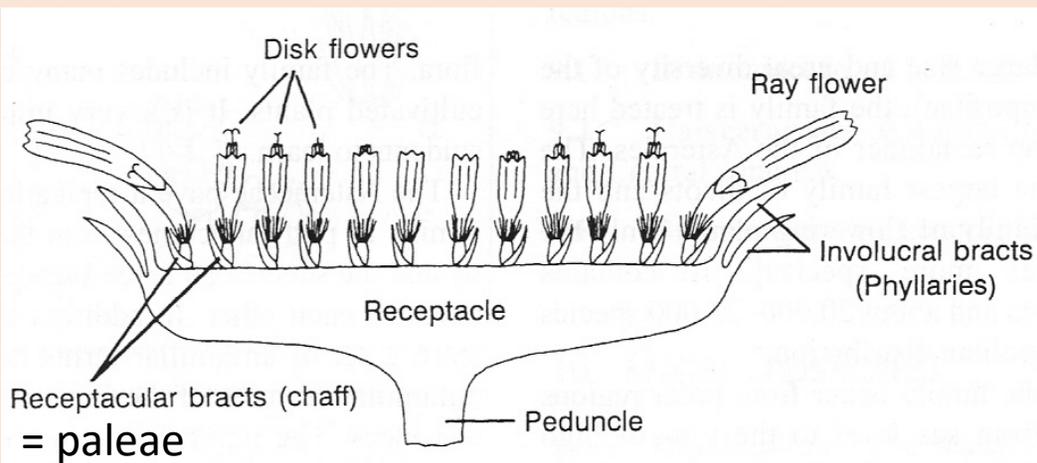
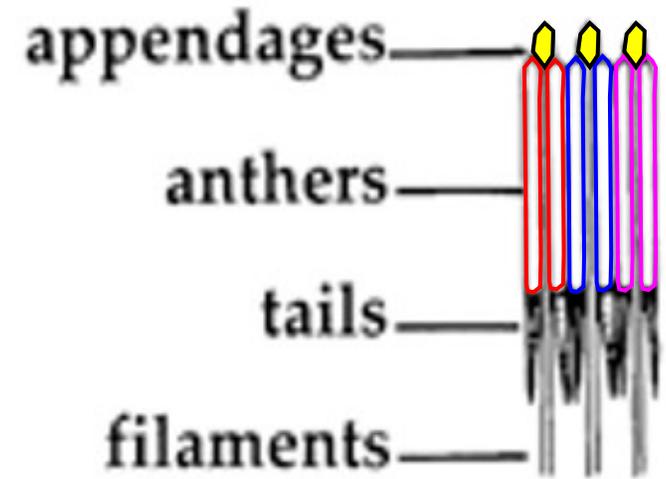
What Makes *Helianthus*?

Member of the Asteraceae

- inflorescence a head (= capitulum)
- involucre subtending the florets
- calyx (sepals) modified to form a pappus
- fruit is a cypsela

Member of the Tribe Heliantheae

- heads usually radiate (rarely discoid or disciform)
- receptacle with or without chaffy bracts (= receptacular bracts, or paleae)
- ray florets pistillate, corollas yellow to orange
- disc florets perfect, corolla yellow to orange, 5-lobed; anther appendages ovate to lanceolate
- pappus usually of scales



What Makes it *Helianthus*?

1-Nuttall's



Member of *Helianthus*

-- capitula radiate

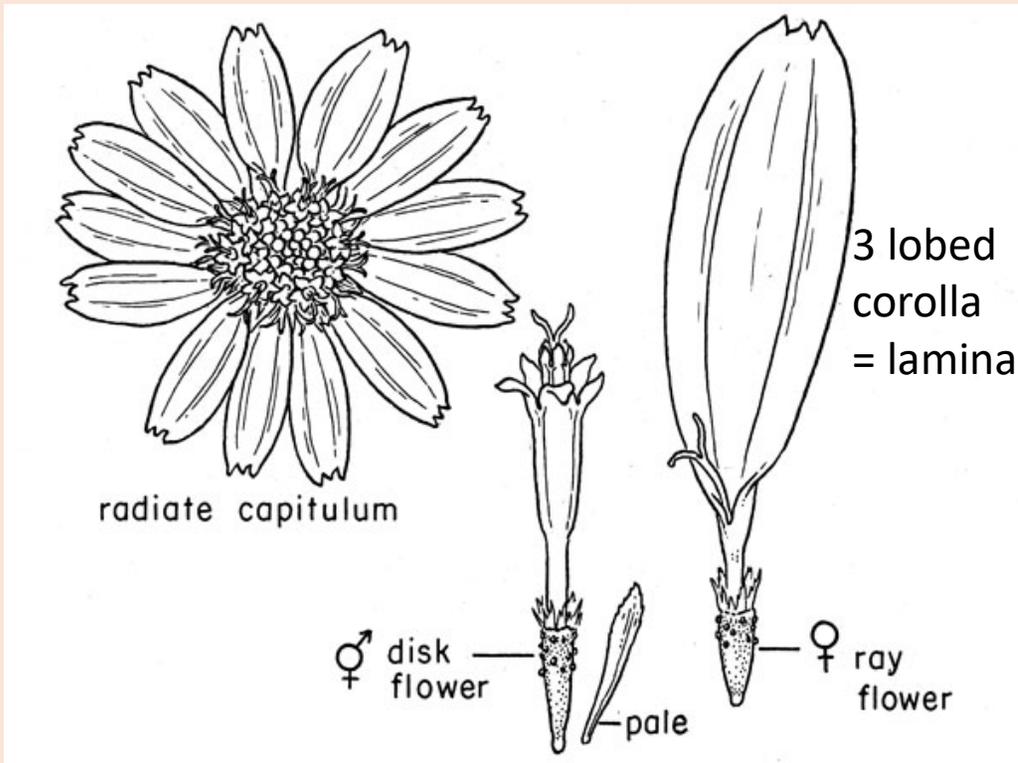
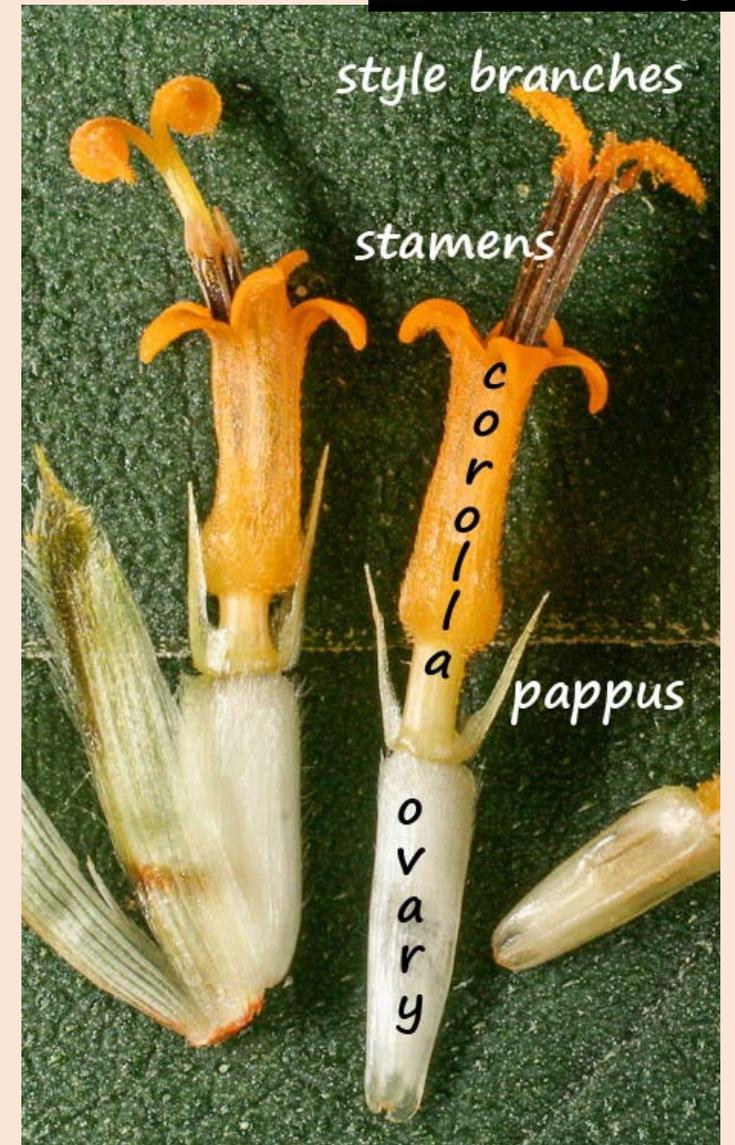
-- receptacle flat to slightly convex, paleae \pm concave and enclosing floret, usually rectangular-oblong, 3-toothed, sometimes entire, apices sometimes reddish or purplish

-- involucre hemispheric, phyllaries 11-40 in 2-3+ series,

-- ray florets 5-30, neuter, corollas yellow

-- disc florets 30-150, perfect, corollas yellow or reddish distally, 5-lobed

-- pappus of 2 lanceolate aristate scales, 1-5 mm



Comparison table for genera in Asteraceae Tribe Heliantheae with yellow or yellowish-orange ray corollas.

	<i>Helianthus</i>	<i>Heliopsis</i>	<i>Bidens</i>	<i>Coreopsis</i>	<i>Silphium</i>	<i>Rudbeckia</i>
Leaves	simple, alternate or opposite, sometime basal, sessile or petiolate, linear to deltoid, sometime abaxial glandular	simple, opposite, petiolate, ovate to deltate-lanceolate	simple or compound, opposite or whorled, sometimes basal, sessile to petiolate	simple, compound or basal, opposite or alternate, lobed or unlobed, sessile or petiolate	simple, basal, alternate, or opposite, lobed or unlobed, sessile to petiolate	simple, basal and alternate, lower long petiolate, petioles becoming shorter distally, usually lobed
Heads	radiate, rarely discoid	radiate	radiate or discoid	radiate	radiate	radiate or discoid
Receptacle	paleae rectangular-oblong, tip \pm 3-toothed, concave, enclosing the florets	paleae 8.0-8.8 mm long, oblong-lanceolate, concave and enclosing florets, yellowish	paleae linear to narrowly oblong to lanceolate, flat to slightly concave, yellowish	paleae ovate to linear or subulate, \pm flat, not or only slightly enclosing the florets	paleae narrowly oblong to linear, fairly flat, margins not or only slightly enclosing florets	receptacle elongating during maturation, paleae concave, enclosing florets, the tip sharply pointed
Phyllaries	12-40, narrowly lanceolate to ovate, tips appressed or spreading, margins & abaxial often hairy	mostly 15-30 in 2-3 series, lanceolate to ovate, rounded to acute	mostly 8-21 in \pm 2 series, distinct sometimes slightly connate	usually 8 in 2 series, outer shorter and narrower than others, tapered to a sharp tip	11-45 in 2-4 series, outer broader, foliaceous, tips spreading, inner smaller and thinner	5-25 in 1-2 series, linear to narrowly lanceolate or ovate, spreading or reflexed moderately hairy
Ray florets	5-30, neuter, corolla yellow, fairly broad	8-16, pistillate, corollas 15-40 mm, pale yellow to orange yellow	absent or 3-13, neuter corolla 2-30 mm, usually yellow, sometimes white, not persistent in fruit	mostly 8, neuter (or pistillate and fertile); corollas 12-30 mm, yellow, sometimes reddish-brown proximally	13-35 in 2 or 3 series pistillate, fertile, corolla 15-50 mm, yellow or rarely white	5-21, neuter, corolla yellow, yellowish orange, sometimes reddish toward the base, sometimes drooping
Pappus	2 short awns, 1-5 mm sometimes with 1-6 inconspicuous, very short scales or awns	0 or 2-4 minute tooth-like scales	rarely absent, typically 2-4 short or long awns with upward or downward barbs	2 short awns, smooth or with upward barbs sometimes reduced to a low crown	0 or that of the ray florets of 2 short, triangular awns confluent with the cypsela shoulders	0, a low crown, or 2-6 minute scales
Secondary Inflorescence	Heads born singly or in corymbiform, paniculiform or spiciform arrays	heads born singly	heads in corymbiform arrays, or sometimes in small fascicles of 2 or 3, or born singly	heads born singly or in open corymbiform arrays	heads in paniculiform or racemiform arrays	heads borne singly or in corymbiform arrays

Helianthus Reference Table. Data compiled by Dr. Thomas Rosburg from Schilling 2006, Eilers and Roosa 1994, Kartesz 2015, Voss and Reznicek 2012, Yatskievych 2006, Iowa Natural Areas Inventory

Fields

1-Currently accepted scientific name in Flora of North America. Iowa status (if listed) and data concerning occurrence in Iowa. Iowa Coefficient of Conservatism. Species with shading are most likely to be encountered and included in further discussion. Green = forest, woodland species, yellow = grassland species, blue = wetland species.

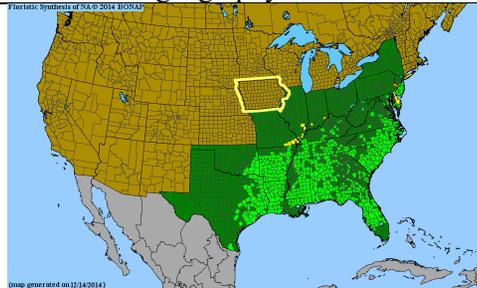
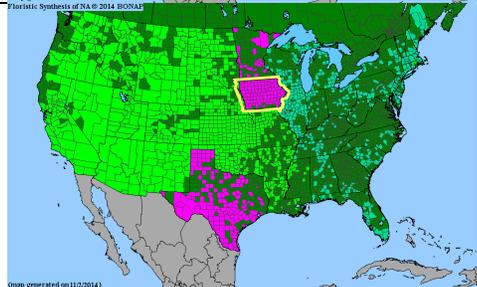
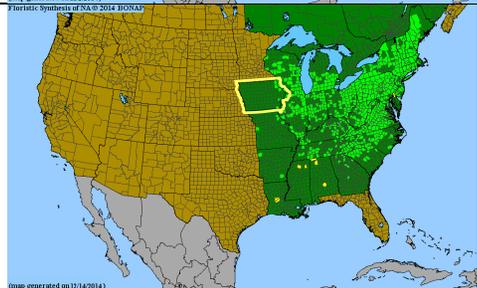
2-Nomenclature and synonyms in Eilers and Roosa 1994. Key identification characteristics.

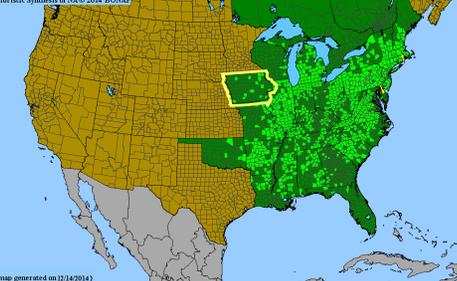
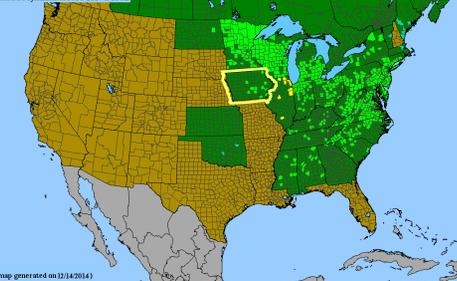
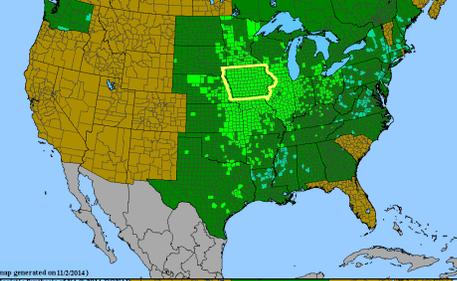
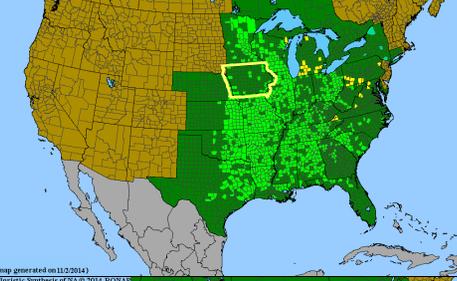
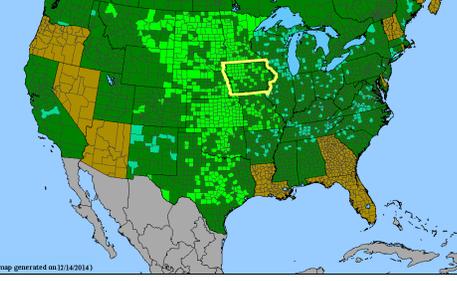
3-Common names indicated by Eilers and Roosa 1994 or observed in general use.

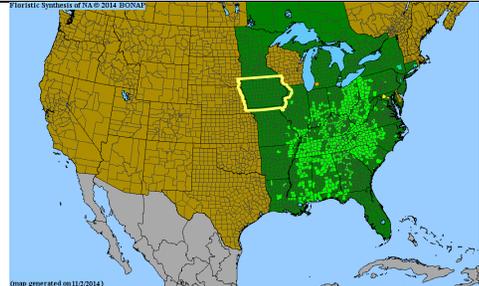
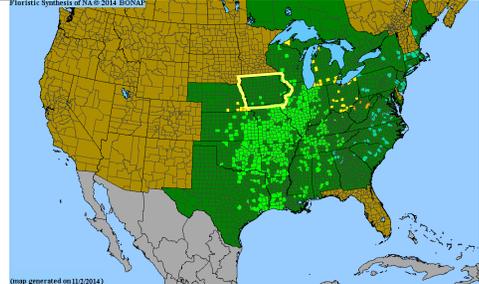
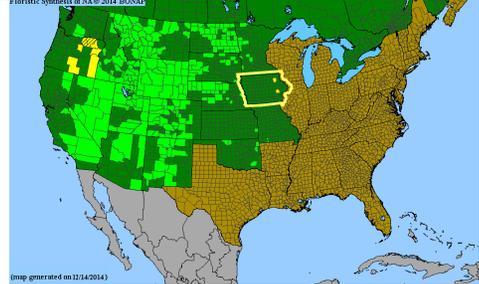
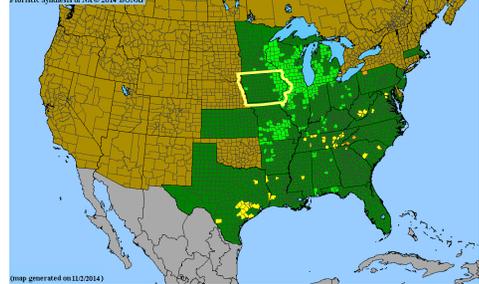
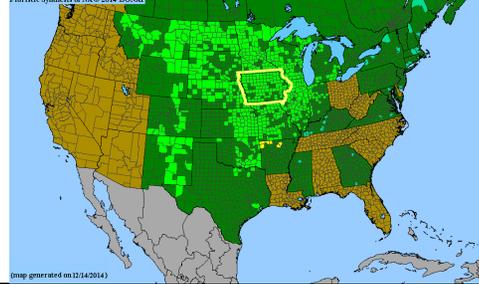
4-General habitat description

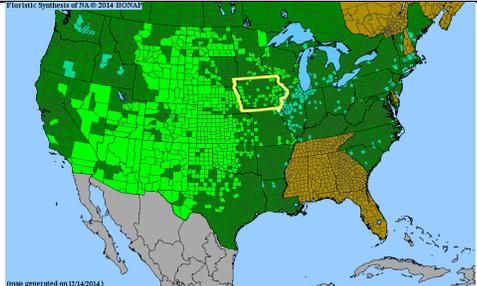
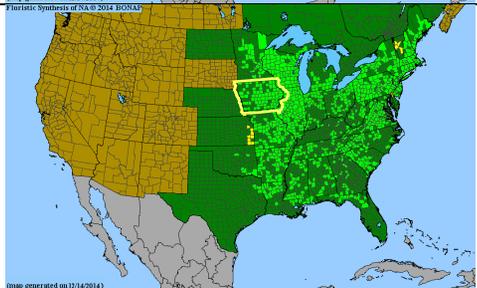
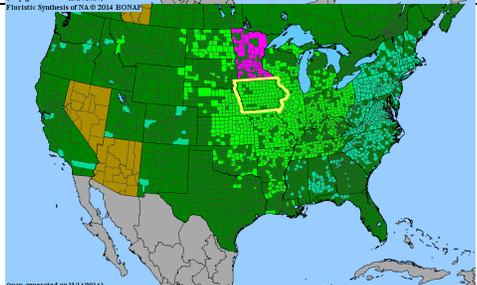
5-Biogeographical range according to BONAP **NOTE: USE RANGE MAPS IN IOWA PRAIRIE PLANTS FOR DESIGNING SEED MIXES**

Digital version available at: <http://uipress.lib.uiowa.edu/ppi/>

Flora of North America	Eilers and Roosa 1994	Common Names	Habitat	BONAP Biogeography
<i>Helianthus angustifolius</i> Status: accidental/non-native Iowa CC: pending	New Species	narrow leaf sunflower <u>similar species:</u>	open to shaded, usually moist places, upland prairies and savannas, pastures	
<i>Helianthus annuus</i> Status: native Iowa CC: 0 to 1 H	<i>Helianthus annuus</i>	common sunflower <u>similar species:</u> prairie sunflower	disturbed open areas, fields, roadsides, sand prairies, streambanks	
<i>Helianthus decapetalus</i> Status: native Iowa CC: 5 to 7 H	<i>Helianthus decapetalus</i>	pale sunflower <u>similar species:</u> pale-leaf woodland sunflower	mesic to wet woodland edges, bottomland forest, forest slopes and ravines	

<p><i>Helianthus divaricatus</i></p> <p>Status: native Iowa CC: 5 to 5 L</p>	<p><i>Helianthus divaricatus</i></p>	<p>rough woodland sunflower</p> <p><u>similar species:</u> hairy sunflower</p>	<p>dry, open woodlands and forests, glades, savannas</p>	
<p><i>Helianthus giganteus</i></p> <p>Status: native? Iowa CC: pending</p>	<p><i>Helianthus giganteus</i></p>	<p>tall sunflower</p> <p><u>similar species:</u> Maximilian's sunflower</p>	<p>usually wet, open sites, mesic prairie, shorelines</p>	
<p><i>Helianthus grosseserratus</i></p> <p>Status: native Iowa CC: 4 to 3 H</p>	<p><i>Helianthus grosseserratus</i></p>	<p>saw-tooth sunflower</p> <p><u>similar species:</u> Maximilian's sunflower</p>	<p>dry, mesic to wet prairies, streambanks, shorelines, disturbed open sites, fields, pastures, roadsides</p>	
<p><i>Helianthus hirsutus</i></p> <p>Status: native Iowa CC: 5 to 5 L</p>	<p><i>Helianthus hirsutus</i></p>	<p>hairy sunflower bristly sunflower</p> <p><u>similar species:</u> rough woodland sunflower</p>	<p>dry to mesic open woodland and forest, forest edges, savannas, upland prairie, streambanks, pastures, roadsides</p>	
<p><i>Helianthus maximiliani</i></p> <p>Status: native Iowa CC: 4 to 5 L may be planted outside its native range</p>	<p><i>Helianthus maximiliani</i></p>	<p>Maximilian's sunflower</p> <p><u>similar species:</u> tall sunflower saw-tooth sunflower</p>	<p>prairies, glades, savannas, fields, roadsides, disturbed open areas</p>	

<p><i>Helianthus microcephalus</i></p> <p>Status: unknown Iowa CC: pending</p>	<p>New Species</p>	<p>small woodland sunflower</p> <p><u>similar species:</u> western sunflower</p>	<p>mesic upland forests, open woodlands, shaded roadsides, streambanks</p>	
<p><i>Helianthus mollis</i></p> <p>Status: native Iowa CC: 6 to 6 L</p>	<p><i>Helianthus mollis</i></p>	<p>ashy sunflower</p> <p><u>similar species:</u> rough woodland sunflower hairy sunflower</p>	<p>dry prairies, glades, pastures, fields, roadsides, railroad ROWs</p>	
<p><i>Helianthus nuttallii</i> subsp. <i>parishii</i> subsp. <i>nuttallii</i> subsp. <i>rydbergii</i> *</p> <p>Status: unknown Iowa CC: pending</p>	<p>New Species</p>	<p>Nuttall's sunflower</p> <p><u>similar species:</u> hairy sunflower pale-leaf woodland sunflower</p>	<p>open areas, sandy dry soils, wet places</p>	
<p><i>Helianthus occidentalis</i> subsp. <i>occidentalis</i> * subsp. <i>plantagineus</i></p> <p>Status: native Iowa CC: 8 to 8 H</p>	<p><i>Helianthus occidentalis</i></p>	<p>western sunflower</p> <p><u>similar species:</u> small woodland sunflower</p>	<p>dry prairies, sandy soils, glades, savannas, dry open forest and woodland, fields, barrens</p>	
<p><i>Helianthus pauciflorus</i> subsp. <i>pauciflorus</i> * subsp. <i>subrhomboideus</i> *</p> <p>Status: native Iowa CC: 8 to 8 M</p>	<p><i>Helianthus rigidus</i> subsp. <i>subrhomboideus</i> = <i>H. laetiflorus</i></p>	<p>rigid sunflower stiff sunflower prairie sunflower</p> <p><u>similar species:</u> Jerusalem-artichoke</p>	<p>dry, mesic to wet-mesic prairies, glades, savannas, dry, open forest, pastures, roadsides</p>	

<p><i>Helianthus petiolaris</i> subsp. <i>petiolaris</i> * subsp. <i>fallax</i></p> <p>Status: native Iowa CC: * to 2 L</p>	<p><i>Helianthus petiolaris</i></p>	<p>prairie sunflower</p> <p><u>similar species:</u> common sunflower</p>	<p>dry open, usually sandy soils, sand prairie, roadsides, quarries,</p>	
<p><i>Helianthus strumosus</i></p> <p>Status: native Iowa CC: 5 to 4 H</p>	<p><i>Helianthus strumosus</i> = <i>H. trachelifolius</i></p>	<p>pale-leaf woodland sunflower</p> <p><u>similar species:</u> Nuttall's sunflower pale sunflower</p>	<p>woodlands and forest, prairies, streambanks, roadsides</p>	
<p><i>Helianthus tuberosus</i></p> <p>Status: native Iowa CC: 0 to 2 H</p>	<p><i>Helianthus tuberosus</i></p>	<p>Jerusalem-artichoke</p> <p><u>similar species:</u> rigid sunflower</p>	<p>mesic prairie, bottomland forest, mesic upland forest, streambanks, shorelines, pastures, roadsides, fields, disturbed areas</p>	

Hybrid species

Helianthus x intermedius = *H. maximiliani* and *H. grosseserratus*

Helianthus x cinereus = *H. mollis* and *H. occidentalis*

Helianthus x doronicoides = *H. mollis* and *H. giganteus*

Helianthus x laetiflorus * = *H. tuberosus* and *H. pauciflorus* (hybrids and backcrosses)

Helianthus is a taxonomically difficult genus. Three reasons stand out: 1) developmental and ecologic plasticity (acclimation), 2) the frequency of interspecific hybridization, and 3) the presence of polyploidy.

Helianthus species unknown for Iowa, but which occur in adjacent states

Helianthus ciliaris (IL, NE)

Helianthus salicifolius (MO, NE)

Helianthus silphoides (MO, IL)

Splitting up 12 Iowa *Helianthus* species



GROUP A

Leaves mostly alternate

* plant annual, with taproots; disc floret corollas reddish-brown to dark purple (at least the lobes and upper portion of the tube); largest leaf blades usually ovate to triangular-ovate or broadly ovate **common & prairie**

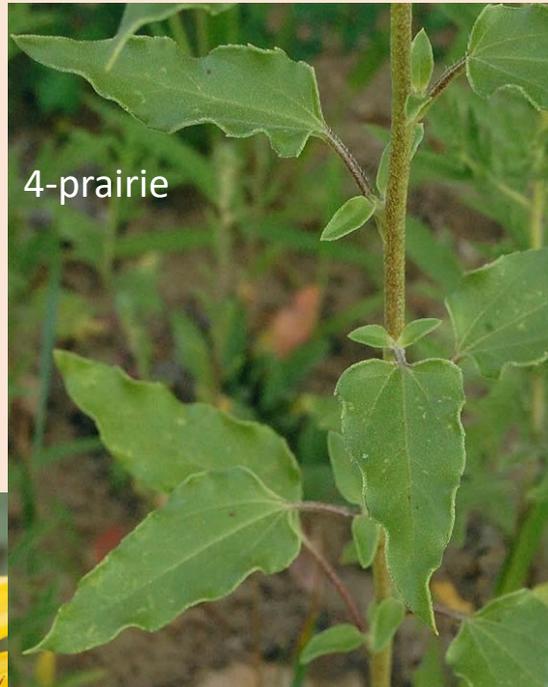
* plant perennial, with a coarse sometimes woody rootstock and short to long rhizomes; disc floret corollas yellow; largest leaf blades usually lanceolate to narrowly oblong-elliptic or narrowly ovate **sawtooth & Maximilian**

GROUPS B, C, D

Leaves mostly opposite

→ phyllaries ovate to lance-ovate and abruptly long acuminate, margins and abaxial surface with long stiff hairs **common**

→ phyllaries lance-elliptic to lance-ovate, apices short-attenuate, abaxial faces usually hispidulous **prairie**



GROUP A

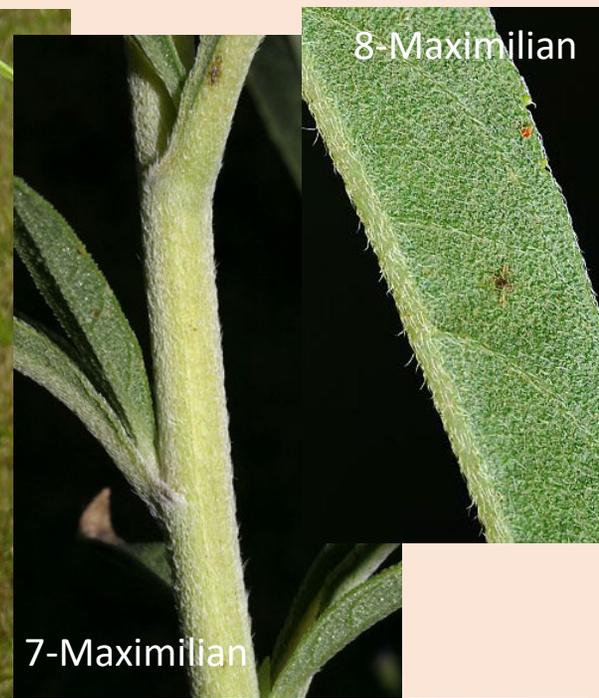
Leaves mostly alternate, plants perennial

→ mid-cauline leaves sessile or subsessile, if petiolate petioles less than 4 mm long, leaves mostly narrowly lanceolate, conduplicate at maturity, margins entire or sometimes serrulate; stem with ± appressed hairs, the upper part usually with evident dense white antrorse pubescence **Maximilian**

→ mid-cauline leaves with petioles (± winged) over 15 mm long, leaves lanceolate to lance-ovate, margins usually coarsely to shallowly serrate; stems glabrous or essentially so, even glaucous, especially toward the base **sawtooth**



6-Maximilian



8-Maximilian

7-Maximilian



9-Maximilian



10-Maximilian



4-sawtooth



2-sawtooth



5-sawtooth



3-sawtooth (abaxial leaf)



1-sawtooth

GROUPS B, C

Leaves mostly opposite

GROUPS C, D

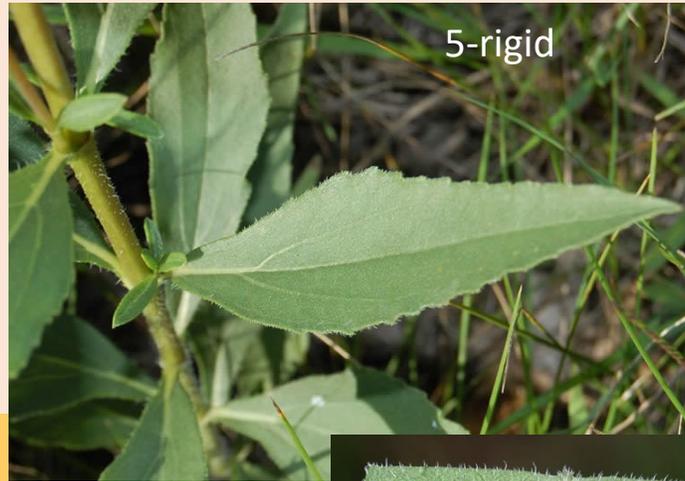
Involucral bracts in 2-4 subequal, ± imbricate series, the tips spreading at flowering

GROUP B

Involucral bracts in 3-4 noticeably unequal, imbricate series, either tightly or somewhat appressed at flowering

* disc floret corollas reddish brown to dark purple (at least the lobes and upper portion of the tube); leaves well-developed along the stem, 5-15 pairs **rigid**

* disc floret corollas yellow; leaves mostly basal, the 3-8 pairs of stem leaves much smaller than those of the basal rosette **western**



GROUPS C, D

Involucral bracts in 2-4 subequal, ± imbricate series, the tips spreading at flowering



GROUP C

Stem leaves all sessile or with a minute petiole less than 5 mm long, the blade rounded or shallowly cordate at the base

* stems and leaves moderately to densely pubescent with short, spreading hairs, appearing grayish

ashy
* stems and upper leaf sparsely to moderately pubescent with short, stiff, pustular-based hairs, not appearing uniformly grayish, leaves strongly roughened to the touch

→ stems glabrous or pubescent only toward the tip and below heads, sometimes glaucous; involucre 10-15 mm in diameter; disc floret corollas 4.0-5.5 mm long

rough woodland
→ stems pubescent throughout or at least above the midpoint, not glaucous; involucre 15-20 mm in diameter; disc floret corollas 5.5-6.5 mm long
hairy

GROUP D

At least the largest stem leaves short- to long-petiolate, the petiole more than 5 mm long or, if appearing nearly sessile, then the blade angled or tapered at the base to a poorly defined, winged petiole



GROUP C



GROUP D

petiole more than 5 mm

* leaf blades with a single midvein; stems often with 20-25 pairs of leaves **sawtooth, see Group A**

* leaf blades with 3 main veins, the lateral pair arching upward from at or near the blade base; stems usually with 8-20 pairs of leaves

→ stems glabrous or pubescent only toward the tip and along the inflorescence branches, sometimes somewhat glaucous

- leaf blades relatively thin-textured, those of at least the larger leaves with the margins usually coarsely serrate; petioles of at least the larger leaves 2-5 cm long **pale**

- leaf blades relatively thick-textured, the margins entire or finely serrate; petioles of the larger leaves 1-3 cm long **pale-leaf woodland**

→ stems sparsely to moderately pubescent, at least above the midpoint, not glaucous

- leaf blades 0.7-9.0 cm wide, bases rounded or short-tapered to a fairly well-differentiated petiole 0.5-1.5 cm long; rhizomes not forming tubers **hairy**

- leaf blades 6.0-15 cm wide, tapered at the base to a partially winged, sometimes poorly differentiated petiole 2.0-8.0 cm long; rhizome branches usually with small tubers at the tip **Jerusalem-artichoke**

GROUP D



GROUP D all Jerusalem-artichoke



References

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Iowa *Helianthus*

Adapted from keys in Yatskievych, G. 2006. Steyermark's Flora of Missouri Volume 2. Missouri Botanical Garden Press; Voss, E.G. and A.A. Reznicek 2012. Field Manual of Michigan Flora. University of Michigan; and Schilling, E.E. 2006. *Helianthus*. In: Flora of North America Editorial Committee, eds. 1993+. Flora of North America North of Mexico. 21+ vols. New York and Oxford. Vol. 21, page 166
by Thomas R. Rosburg (January 2021)

- 1a. Leaves all or mostly alternate (may appear relatively crowded on the stem)
 - 2a. Leaf blades narrow, 7-20 times as long as wide, those of the largest leaves 0.1-1.0(-1.5) cm wide, linear to narrowly lanceolate
 - 3a. Leaves mostly narrowly lanceolate, conduplicate at maturity, with relatively flat margins; disc floret corollas yellow.....*H. maximilianii* (in part, Maximilian's sunflower)
 - 3b. Leaves all or mostly linear, not conduplicate, with the margins revolute; disc floret corollas reddish brown to dark purple (at least the lobes and upper portion of the tube).....*H. angustifolius* (narrow-leaved sunflower)
 - 2b. Leaf blades broad to moderately narrow, mostly 1.2-10.0 times as long as wide, those of the largest leaves 1-35 cm wide, lanceolate to broadly ovate-triangular
 - 4a. Plant annual, with taproots; disc floret corollas reddish-brown to dark purple (at least the lobes and upper portion of the tube); receptacle flat to slightly convex; largest leaf blades usually ovate to triangular-ovate or broadly ovate
 - 5a. Involucral bracts with long, spreading hairs along the margins and often also on the outer (abaxial) surface; paleae with inconspicuous, short hairs toward the tip; fruits densely and minutely pubescent when young, but usually glabrous or nearly so at maturity.....*H. annuus* (common sunflower)
 - 5b. Involucral bracts with minute ascending to sometimes more or less spreading hairs along the margins and the outer (abaxial) surface; paleae with the middle lobe densely pubescent with conspicuous white hairs at the tip; fruits usually persistently moderately short pubescent, at least along the margins.....
.....*H. petiolaris* (prairie sunflower)
 - 4b. Plant perennial, with a coarse sometimes woody rootstock and short to long rhizomes; disc floret corollas yellow; receptacle convex to short conical; largest leaf blades usually lanceolate to narrowly oblong-elliptic or narrowly ovate
 - 6a. Principal mid-cauline leaves (if not all) sessile or subsessile (with petioles, if any, less than 4 mm long)
 - 7a. Leaves as scabrous beneath as they are above, linear to narrowly elliptic-lanceolate, usually conduplicate, arcuate, and entire (rarely toothed); stem with ± appressed hairs, the upper part (or peduncles) usually with evident dense white antrorse pubescence; phyllaries with margins very rarely bearing cilia as long as 1 mm and at least some with tip prolonged into a soft, non-green bristle..... *H. maximilianii* (in part, Maximilian's sunflower)
 - 7b. Leaves less densely scabrous or smooth beneath (although softer pubescence may be present), narrowly elliptic to ovate-lanceolate, flat, not conduplicate, ± distinctly though shallowly toothed; stem with spreading hairs, the upper part (or peduncles) seldom with appressed white pubescence; phyllaries with marginal cilia mostly 1 mm or more long and with tip acute or attenuate but hardly bristle-like.....*H. giganteus* (in part, tall sunflower)
 - 6b. Principal mid-cauline leaves with petioles (± winged) over 5 mm long
 - 8a. Stems variously pubescent to glabrate (sometimes glaucous), or at least scabrous from bases of worn hairs; petioles 0 to 15 mm
 - 9a. Stems (usually reddish) erect; leaves subsessile or petiolate, petioles 0-12 mm, ciliate; abaxial faces of leaves scabrous or ± hirsute; anther appendages dark brown or black..... *H. giganteus*
(in part, tall sunflower)
 - 9b. Stems (usually yellow-brown or greenish) erect; leaves petiolate, petioles 5-15 mm, not ciliate; abaxial faces of leaves hispid to villous or tomentose; anther appendages yellow.....*H. nuttallii*
(in part, Nuttall's sunflower)
 - 8b. Stems glabrous or essentially so, even glaucous, especially toward the base (may be glabrate distally towards the heads); petioles 20-50 mm..... *H. grosseserratus* (in part, sawtooth sunflower)

Iowa *Helianthus*

- 1b. Leaves all or mostly opposite (sometimes appearing mostly basal in *H. occidentalis*)
 - 10a. Disc floret corollas reddish brown to dark purple (at least the lobes and upper portion of the tube); involucre bracts in 3-4 noticeably unequal, imbricate series, tightly appressed at flowering.....*H. pauciflorus*
(rigid sunflower)
 - 10b. Disc floret corollas yellow; involucre bracts in 2-4 subequal, ± imbricate series, loosely appressed and sometimes with spreading tips at flowering (except in *H. occidentalis*, with often unequal, sometimes ± appressed bracts)
 - 11a. Leaves mostly basal, the 3-8 pairs of stem leaves much smaller than those of the basal rosette (occasionally the lowermost pair of stem leaves nearly as large as the basal ones); involucre bracts in 3-4 noticeably unequal, imbricate series, usually appressed at flowering..... *H. occidentalis* (western sunflower)
 - 11b. Leaves well-distributed along the stem, gradually reduced toward the stem tip, the stem leaves usually 8-15 pairs (except rarely in depauperate plants); involucre bracts in 2-4 subequal, ± imbricate series, the tips somewhat spreading at flowering
 - 12a. Heads relatively small, the involucre 5-7 mm long, 4-10 mm in diameter; ray florets 5-8, the corolla 1.0-1.5 cm long.....*H. microcephalus* (small woodland sunflower)
 - 12b. Heads relatively large, the involucre 5-12 mm long, 10-30 mm in diameter; ray florets (8-)10-30, the corolla (1.5-)2.0-4.0 cm long
 - 13a. Stem leaves all sessile or with a minute petiole less than 5 mm long, the blade rounded or shallowly cordate at the base
 - 14a. Stems (at least above the midpoint) and leaves moderately to more commonly densely pubescent with short, spreading hairs and usually also shorter ascending hairs, these mostly not pustular-based, usually appearing uniformly grayish, slightly to moderately roughened to the touch...*H. mollis* (ashy sunflower)
 - 14b. Stems sparsely to moderately pubescent (at least above the midpoint) with short, stiff, loosely ascending to spreading pustular-based hairs; leaves moderately pubescent, the upper surface with short, stiff, loosely ascending to spreading pustular-base hairs, not appearing uniformly grayish, strongly roughened to the touch (the undersurface somewhat lighter in color and sometimes with softer hairs than the upper surface)
 - 15a. Stems glabrous or pubescent only toward the tip and along the inflorescence branches, sometimes somewhat glaucous; involucre 10-15 mm in diameter; disc floret corollas 4.0-5.5 mm long; lowest lateral veins of leaf usually joining midrib at base of blade*H. divaricatus* (rough woodland sunflower)
 - 15b. Stems pubescent throughout or at least above the midpoint, not glaucous; involucre (10-)15-20 mm in diameter; disc floret corollas (5.0-)5.5-6.5 mm long; lowest lateral veins of leaf joining midrib slightly above base of blade*H. hirsutus* (in part, hairy sunflower)
 - 13b. At least the largest stem leaves short- to long-petiolate, the petiole more than 5 mm long or, if appearing nearly sessile, then the blade angled or tapered at the base to a poorly defined, winged petiole
 - 16a. Leaf blades with a single midvein; stems often with 20-25 pairs of leaves... *H. grosseserratus* (in part)
(sawtooth sunflower)
 - 16b. Leaf blades with 3 main veins, the lateral pair arching upward from at or near the blade base; stems usually with 8-20 pairs of leaves
 - 17a. Stems glabrous or pubescent only toward the tip and along the inflorescence branches, sometimes somewhat glaucous
 - 18a. Leaf blades relatively thin-textured, those of at least the larger leaves with the margins usually coarsely serrate; petioles of at least the larger leaves 2-5 cm long; involucre bracts extending conspicuously beyond the disc florets.....*H. decapetalus* (pale sunflower)
 - 18b. Leaf blades relatively thick-textured, the margins entire or finely serrate; petioles of the larger leaves 1-3 cm long; involucre bracts extending to about the tips of the disc florets
 - 19a. Anther appendages dark or reddish brown.....*H. strumosus* (pale-leaf woodland sunflower)
 - 19b. Anther appendages yellow.....*H. nuttallii* (in part, Nuttall's sunflower)
 - 17b. Stems sparsely to moderately pubescent, at least above the midpoint, not glaucous

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20a. Leaves with the blade 0.7-9.0 cm wide, bases rounded or short-tapered to a relatively well-differentiated petiole 0.5-1.5 cm long; rhizomes not producing tubers

21a. Stems mostly hirsute, sometimes glabrate towards the base, not glaucous; leaf bases truncate to broadly rounded or broadly cuneate (obtuse); leaves mostly opposite..... *H. hirsutus* (in part, hairy sunflower)

21b. Stems variable, glabrous and sometime glaucous, to somewhat hispid, hirsute or scabrous; leaf bases cuneate; leaf arrangement varies from mostly opposite to mostly alternate *H. nuttallii*
(in part, Nuttall's sunflower)

20b. Leaves with the blade 6-15 cm wide, tapered at the base to a partially winged, sometimes poorly differentiated petiole (1.5-)2.0-8.0 cm long; rhizome branches usually with small tubers at the tip.....*H. tuberosus*
(Jerusalem artichoke)

alt 6a. Stems glabrous below the midpoint, often sparsely to moderately pubescent with short, ascending hairs toward the tip; leaf blades flat or only shallowly concave, not conduplicate, the upper surface sparsely to moderately pubescent with minute, broad-based hairs, usually only slightly roughened to the touch.....*H. grosseserratus*

alt 6b. Stems moderately roughened-pubescent with short, ascending hairs throughout, more densely so toward the tip; leaf blades conduplicate at maturity, the upper surface moderately to densely pubescent with short pustular-based hairs, strongly roughened to the touch..... *H. maximilianii*

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by Thomas R. Rosburg (January 2021)

1a. Annuals or perennials (taprooted); leaves mostly alternate, petiolate (petiole lengths at least $\frac{1}{3}$ blades); paleae (at least central ones) either bearded (with apical tufts of whitish hairs) or prominently 3-toothed (middle teeth relatively narrow, lengths 4 or more times width); disc corolla lobes and style branches usually reddish (rarely yellow in *H. annuus*)

2a. Plants 100-300 cm; leaf blades (at least larger) 10-40 cm wide, abaxial faces gland-dotted; phyllaries ovate to lance-ovate (larger usually 5–8 mm wide), apices narrowed abruptly (acute to acuminate); stems (leaves, phyllaries) hispid *H. annuus*

2b. Plants mostly 25-200 cm; leaf blades (larger) usually less than 12 cm wide (bases cuneate, truncate, or cordate), abaxial faces sometimes gland-dotted; phyllaries usually lanceolate to lance-ovate (usually less than 4 mm, sometimes to 5 mm, wide), apices narrowed gradually; stems (leaves, phyllaries) densely canescent *H. petiolaris*

1b. Perennials (rhizomatous or with crown buds); leaves opposite or alternate, petiolate or sessile; paleae (at least central) glabrous or \pm hispid to puberulent (not bearded) and entire or relatively weakly 3-toothed (if 3-toothed, lengths of middle teeth usually less than 4 times widths); disc corolla lobes yellow or reddish (if reddish, style branches yellow)

3a. Leaves (at flowering) mostly or all basal (cauline leaves abruptly smaller)

4a. Phyllaries lanceolate (the larger 1.5-2.5 mm wide); abaxial faces of leaves (and usually ray laminae) notably gland-dotted; disc corolla lobes yellow; cypselae 3–5 mm *H. occidentalis*

4b. Phyllaries lanceolate to ovate (the larger 3+ mm wide); abaxial faces usually not gland-dotted (if gland-dotted, cypselae 5-6 mm); disc corolla lobes reddish or yellow *H. pauciflorus*

3b. Leaves (at flowering) mostly cauline (not abruptly smaller distally)

5a. Disc corolla lobes reddish (at least at tips)

6a. Leaf blades lanceolate, lance-linear, or linear (lengths usually 10+ times widths)..... *H. angustifolius*

6b. Leaf blades deltate, deltate-ovate, lanceolate, lance-ovate, or linear (lengths seldom more than 5 times widths)..... *H. pauciflorus*

5b. Disc corolla lobes yellow

7a. Phyllaries ovate to lanceolate, (3-)5-8 mm wide, apices abruptly attenuate (disc corolla throats notably bulbous at bases)..... *H. annuus*

7b. Phyllaries linear to lanceolate or lance-ovate, usually 2-4 mm wide, apices gradually narrowed (disc corolla throats not notably bulbous at bases)

8a. Stems glabrous or glabrate (at least proximal to arrays of heads, sometimes glaucous)

9a. Involucres 5-7 mm diam; rays usually 5 or 8..... *H. microcephalus*

9b. Involucres (8-)9-28 mm diam.; rays (8-)10-21 (at least in larger heads)

10a. Leaves sessile (3-nerved from bases), bases rounded to cordate..... *H. divaricatus*

10b. Leaves sessile or petiolate (3-nerved distal to bases), bases \pm cuneate (narrowing gradually)

11a. Anther appendages yellow

12a. Leaves petiolate, the petioles 2.5-10 cm, lengths $\frac{1}{2}$ + blades; blades oblong-lanceolate or elliptic to ovate; phyllaries usually appressed, strongly un-equal, not surpassing discs..... *H. occidentalis*

12b. Leaves sessile or if petiolate the petioles less than 5 cm, lengths usually less than $\frac{1}{4}$ blades; blades lanceolate to lance-ovate; phyllaries usually loose, spreading, \pm subequal

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- 13a. Leaves with petioles (1-)2-5 cm, blades 10-32 × (1.2-)4-9 cm, margins coarsely serrate.....*H. grosseserratus*
13b. Leaves with petioles 0.5–1.5 cm, blades 4-20 × 0.8-4 cm, margins entire or shallowly serrate.....*H. nuttallii*

11b. Anther appendages dark or reddish brown

- 14a. Leaves with petioles 1-3 cm, blades moderately serrate or entire, abaxial faces usually densely gland-dotted; phyllaries (equaling or slightly surpassing discs), apices acute.....*H. strumosus*
14b. Leaves: petioles 2–5 cm, blades (at least larger leaves) moderately to notably serrate, abaxial faces usually sparsely gland-dotted; phyllaries (at least longer, usually surpassing discs, by ½+ their lengths), apices acuminate..... *H. decapetalus*

8b. Stems hairy (± throughout, not glaucous)

- 15a. Leaves all or mostly opposite, sessile, bases cordate.....*H. mollis*
15b. Leaves opposite or alternate, petiolate or sessile, bases mostly cuneate (not cordate)

- 16a. Leaf blades (usually 1-nerved, conduplicate) entire; heads (1-)3-15, borne singly or in racemiform or spiciform arrays.....*H. maximiliani*
16b. Leaf blades (3-nerved, not conduplicate) entire or serrate; heads (1-)3-16, borne singly or in ± corymbiform arrays, not racemiform or spiciform arrays

- 17a. Phyllaries usually appressed, strongly unequal.....*H. occidentalis*
17b. Phyllaries usually loose or spreading, ± subequal

- 18a. Leaves petiolate, petioles 2-8 cm; blades lanceolate to ovate, 7-15 cm wide; cypselae 5-7 mm; plants producing tubers late in growing season*H. tuberosus*
18b. Leaves sessile or petiolate, petioles 0-2 cm; blades elliptic, lance-linear, lanceolate, lance-ovate, linear, or ovate, 0.15-4(-8) cm wide; cypselae 2-5 mm; plants sometimes producing tubers

- 19a. Leaves petiolate, blade bases truncate to rounded.....*H. hirsutus*
19b. Leaves petiolate or sessile, blade bases cuneate (gradually narrowing)

- 20a. Leaf margins entire or subentire to serrulate (usually revolute), leaves 0.15-0.5(-1) cm wide; ray laminae gland-dotted abaxially..... *H. angustifolius*
20b. Leaf margins entire or subentire to serrulate (± flat), leaves 0.8-4 cm wide; ray laminae not gland-dotted

- 21a. Stems (usually reddish) erect; leaves subsessile or petiolate (petioles 0–1.2 cm, ciliate), abaxial faces scabrous or ± hirsute; anther appendages dark brown or black.....*H. giganteus*
21b. Stems (usually yellow-brown or greenish) erect; leaves petiolate (petioles 0.5–1.5 cm, not ciliate), abaxial faces hispid to villous or tomentose; anther appendages yellow...*H. nuttallii*