Helianthеae of Iowa, III

M. R. Johns

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Heliantheae of Iowa, III

by

M. Rae Johns

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HELIANTHEAE OF IOWA, III

The two preceding papers on the Heliantheae of Iowa appeared in the Proceedings of the Iowa Academy of Science for 1929 and 1930.

The first series included the genera *Galinsoga, Eclipta, Actinomeris, Parthenium, Polymnia, Ambrosia, Iva* and *Xanthium*—an artificial assemblage of eight small genera grouped for convenience.

In the second series, five conspicuous and well known genera were included, namely: *Heliopsis, Silphium, Rudbeckia, Lepachys* and *Brauneria.* Of these, *Heliopsis* and *Silphium* were shown to have been associated throughout their taxonomic history, and also with them *Galinsoga, Eclipta, Polymnia* and *Parthenium* of Series I, because of their pistillate and fertile ligules. *Rudbeckia, Lepachys* and *Brauneria* were found to form a close natural group, and originally to have been included within the genus *Rudbeckia,* later to be extricated and given equal generic status.

All the genera and species reviewed in these two papers are very distinct, with strong deliminating characters, and so offered little difficulty in identification.

Series III, which includes the three remaining Iowa genera *Helianthus, Coreopsis* and *Bidens,* is here presented and will bring to a close the preliminary survey of the Tribe Heliantheae (Family Compositae) in Iowa.

These three important genera are world-wide in distribution and conspicuous in the flora of all temperate and tropical regions. In Iowa they are well represented by species mostly native to the state, and chiefly of the vigorous and prolific weedy types common to waste places. Their members are also listed among medicinal, economic, and ornamental plants.

They offer difficulties in classification. While they are very distinctive as genera, the species within each genus present many confusing problems of identification. This is because of their ready responses of structure to conditions of environment and also because of probable hybridization in closely related species. Therefore no attempt has been made to place all of the many forms seen in the field nor of plant portions found in herbaria. This would mean

never to complete the survey or to end with a bewildering agglomeration of local environmental forms. As far as possible a positive identification has been made, followed by a carefully worked out description of details, with drawings to aid in recognition of the species. The more striking variations are then given.

It has been left to others of more extensive and world-wide experience in the taxonomic field to create new specific and varietal names for seemingly stable though unnamed forms afield. The way to positive determination of species will be greatly aided by the geneticist who may be able, by the chromosome method, to reveal the true kinship of the "plastic" species of these three genera.

TRIBE HELIANTHEAE

Leaves opposite or alternate, simple or pinnate. Heads radiate or discoid, disk brown or yellow. Disk-flowers perfect and fertile, or sterile. Ray-flowers pistillate and fertile or sterile, or neutral. Receptacle chaffy, flat, or convex to columnar. Involucre of leaf-like green bracts in 2 or more rows. Anthers united, or nearly free, not caudate but mostly entire at base. Style-arms truncate or hairy-appendaged. Akenes flat or angled with margins winged or wingless. Pappus of chaffy scales, 2-4 hard awns, a mere crown, or none.

Key to Genera of Tribe Heliantheae

a. Heads mostly radiate; anthers united . . . . b.
  b. Disk-flowers perfect and fertile; rays neutral or sterile . . . . c.
    c. Rays, when present, neutral or sterile . . . . d.
      d. Receptacle flat to low convex; rays neutral, yellow . . . . e.
        e. Chaff persistent; awns deciduous; rays numerous. *Helianthus*
        e. Chaff deciduous; awns, if present, persistent; rays 2-8 or none . . . . f.
          f. Akenes not winged, awns barbed; rays usually 8, absent in some. *Bidens*
          f. Akenes winged; awns naked or absent; rays 2-8 or absent . . . . g.
            g. Pappus of 2-3 long smooth awns; bracts distinct; rays 2-8, ephemeral or absent. *Actinomeris**
            g. Pappus none or 2 small teeth; bracts united at base; rays 8, rarely absent. *Coreopsis*
      d. Receptacle conical to columnar; rays neutral or sterile . . . . h.
        h. Akenes flattened, margined; chaff hood-shape; rays yellow, neutral. *Lepachys**
        h. Akenes thick, not margined, chaff merely concave; rays yellow or light purple, neutral or sterile . . . . i.

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* Treated in previous papers.

i. Rays light purple, pistillate and sterile; chaff cuspidate, exceeding disk-flower. *Brauneria**

i. Rays orange-yellow, neutral; chaff rounded or spinose, shorter than disk-flower. *Rudbeckia**

e. Rays pistillate and fertile . . . . j.

j. Pappus of 4-5 fimbriate chaffy scales; rays white *Galinsoga**

j. Pappus a mere toothed border; rays yellow or white . . . . k.

k. Receptacle conical; akenes smooth; rays yellow. *Heliopsis**

k. Receptacle flat; akenes roughened and hairy; rays white. *Eclipta**

b. Disk-flowers sterile; rays pistillate and fertile . . . . l.

l. Conspicuously radiate, rays numerous, yellow; receptacle flattened. *Silphium**

l. Inconspicuously radiate, rays few, white; receptacle flat or conical . . . . m.

m. Akenes flat; pappus of 2 squamellate awns or obsolete; receptacle conical. *Parthenium**

m. Akenes thickened; pappus a slight coriaceous ring or none; receptacle flat. *Polymnia**

a. Heads not radiate; anthers barely united or free in maturity . . . . n.

n. Heads with both staminate and pistillate flowers; the latter few and marginal. *Iva**

n. Heads with either staminate or pistillate flowers; the latter 1-3-∞.

o. Bracts of staminate heads united; fruit nut-like, 1-seeded. *Ambrosia**

o. Bracts of staminate heads distinct; fruit bur-like, 2-seeded. *Xanthium**

Genus Helianthus L.

Spec. Pl. 1 ed. 904. 1753.

Vosacan Adans. Fam. 2:130. 1763.
Harpalium Cass. Bul. Soc. Philom. 141. 1818.
Discomela Rafin. Neogenyt. 3. 1825.
Diomedia Bertol. Mem. Acc. Torin. 38:31. 1835.
Chrysis Renealm. ex. DC. Prodr. 5:585. 1836.
Flourensia DC. Prodr. 5:592. 1836.
Echinomeria Nutt. in Trans. Am. Phil. Soc. 7:356. 1841.
Linsecomia Buckl. in Proc. Acad. Sci. Philad. 458. 1861.

Helianthus, from the Greek ἥλιος, the sun, and ἄνθος, a flower, refers to the large rayed inflorescence of this genus, typified by the sunflower. The genus is believed to have made an early geologic appearance in the lower Pliocene period of the Tertiary Age. Originating in Peru, it is indigenous to the Americas, whence its

members have travelled to all tropical and temperate regions of the world.

There are between fifty-five and sixty species of *Helianthus* in America, twenty-four of which are included in the territory covered by Gray's Manual, 7th Edition. In Iowa, the genus is represented by the following known species: *H. annuus* L., *H. petiolaris* Nutt., *H. scaberrimus* Ell., *H. grosseserratus* Martens, *H. giganteus* L., *H. Maximiliani* Schrad., *H. hirsutus* Raf., *H. divaricatus* L., *H. strumosus* L., *H. decapetalus* L., *H. laetiflorus* Pers., *H. occidentalis* Ridd., *H. mollis* Lam., *H. tuberosus* L. and *H. tracheliifolius* Mill. Three additional species have been reported: *H. tomentosus* Michx., *H. doronicoides* Lam. and *H. atrorubens* L., but it has been shown that they are limited to areas in which Iowa is not included.

The species of this genus are large, coarse, annual or perennial herbs, with some woody forms found in the tropics. They inhabit various diversified regions which range from the very moist to the driest areas and they respond to these local conditions by presenting variability of form and by developing such protective structures as harsh strumose surfaces, hairy screens, resin, and extensive, sometimes thickened, root-systems.

They fall into such natural groups that while the extreme types are readily recognized, the hybrids may so conform to either or both parent species as to make classification difficult and doubtful. To this intermingling of related species, add the structural responses to environment, the meager content of early descriptions by the discoverers of the species, the incomplete herbarium material, usually only the upper part of the specimen being preserved, and we have the combined conditions which will continue to cause confusion in this strong genus. It is certain that there are and always will be plants of this genus that cannot be positively placed.

Helianthus is distinguished as a genus by the following typical structures:

Stem: erect and branching, herbaceous.

Leaves: simple, opposite or alternate or both, usually 3-nerved, narrowed upon the petiole or petiole distinct, surface strumose, margins serrate to entire, linear-lanceolate to broad ovate or cordate.

Heads: many flowered, radiate, receptacle chaffy, flat to low convex.

Involucre: hemispheric to depressed, bracts in 2 or 3 series, leaf-

like and green, erect, appressed, squarrose or reflexed, glabrous, ciliate, or hispid.

Ray-flowers: numerous, yellow, neutral.

Disk-flowers: numerous, tubular, 5-lobed, tubes short, lobes brown-purple or yellow, perfect and fertile.

Chaff: entire or tricuspidate, subtending disk-flowers, persistent.

Akene: dark, thick or compressed, angled, summit truncate to rounded, glabrous or nearly so.

Pappus: 2 very deciduous scales or awns, often 2 or more small additional ones.

Underground parts: root annual or perennial, fibrous; axillary buds, crown buds, rhizomes, tubers in a few.

Distinction among the species is based upon the general nature of the surfaces, the branching of the stem, the arrangement, venation, surfaces and margins of the leaves, the position, length and surface of the involucral bracts, the length, shape and pubescence of the chaff, the color, shape, and pubescence of the disk-flowers, the number, color and shape of the rays, the shape of the akene and the awns, and the kind and formations of the root system.

The nearest allies to the genus *Helianthus* L. are *Flourensia* DC., shrubs with obsolete or narrow and acute squamellae and akenes densely villous, and *Viguiera* HBK., herbs with short rounded fimbriate squamellae and akenes very pubescent. In *Helianthus* the receptacle is always chaffy and the akene is nearly if not quite glabrous.

Key to Species of Genus Helianthus

a. Receptacle flat; leaves alternate; disk brown; 2-4 cm. broad; annuals . . . . b.

b. Leaves gray-green, oblong to deltoid-lanceolate; innermost chaff white-bearded. *H. petiolaris*

b. Leaves not gray-green, ovate to cordate; chaff not bearded. *H. annuus*

a. Receptacle convex; leaves alternate or opposite; disk brown or yellow, 1-2.5 cm. broad; perennials . . . . c.

c. Bracts appressed, not exceeding disk; disk brown or yellow . . . . d.

d. Disk brown, bracts closely appressed, obtuse or acute, shorter than disk . . . . e.

e. Stem stout, rough, hispid with short hairs; leaves very thick and rigid, scabrous-hispid on both sides. *H. scaberrimus*

e. Stem slender, hairy with long white hairs; leaves thinnish but very coarse, hirsute on both sides. *H. atrorubens*

d. Disk yellow; bracts not so appressed, acute to acuminate, equalling disk . . . . f.

f. Stem stout, leafy throughout; leaves narrowed into short petioles; heads corymbed, disk 1.5 cm. broad. *H. laetiflorus*

f. Stem very slender, naked above; leaves mostly near base of stem, narrowed into long margined petioles; heads solitary or few, disk 1 cm. broad. *H. occidentalis*

c. Bracts loose, equalling or exceeding disk; disk yellow . . . . g.

g. Leaves mostly alternate throughout . . . . h.

h. Leaves broad lance-oblong, 3-nerved; bracts very long, hairy, squarrose or reflexed; disk 2.5 cm. broad. *H. tomentosus*

h. Leaves narrow, not 3-nerved, bracts spreading, not reflexed; heads smaller . . . . i.

i. Stem smooth and glaucous; leaves coarsely serrate, white-pubescent below. *H. grosseserratus*

i. Stem scabrous and hispid; leaves scabrous on both sides . . . . j.

j. Stem gray appressed-hispidulous; leaves gray-canescent both sides, falcate and conduplicate. *H. Maximiliani*

j. Stem not gray hispid; leaves green both sides, not falcate nor conduplicate. *H. giganteus*

g. Leaves opposite at least to inflorescence . . . . k.

k. Leaves sessile or subsessile . . . . l.

l. Leaves 3-nerved from the middle, narrowed to base of petiole; bracts long attenuate, reflexed. *H. doronicoides*

l. Leaves 3-nerved from broad base; bracts shorter, not reflexed . . . . m.

m. Stem stout, villous to hirsute and hispid; leaves ascending, with broad clasping bases, soft gray-canescent both sides. *H. mollis*

m. Stem slender, mostly glabrous and glaucous, slightly hispid above; leaves divaricate, sessile or very short petioled; green both sides. *H. divaricatus*

k. Leaves distinctly petioled . . . . n.

n. Leaves short petioled . . . . o.

o. Leaves thickish and firm, lighter beneath, narrowed to short margined petioles; bracts equalling disk . . . . p.

p. Leaves hirsute-pubescent beneath; stem stout, bristly hairy; bracts recurved. *H. hirsutus*

p. Leaves whitish and softly pubescent beneath; stem smooth and glaucous, or sparsely hispid above; bracts with tips merely squarrose. *H. strumosus*

o. Leaves thinner, nearly equally green both sides, the petioles not margined; bracts attenuate, much exceeding disk. *H. tracheliifolius*

n. Leaves longer petioled . . . . q.

q. Stem mostly smooth, slightly hispid above; bracts at-

tenuate, often much exceeding disk, spreading; rhizomes not tuber bearing. *H. decapetalus*

q. Stem scabrous and hispid; bracts not much exceeding disk, squarrose; rhizomes tuber bearing. *H. tuberosus*

Helianthus annuus L.

Sp. pl. 904. 1753.

Helianthus indicus L. Mant. 1:114. 1761.
Helianthus tubaeformis Nutt. Gen. N. Am. 2:177. 1818.
Helianthus platycephalus Cass. Dict. Sci. Nat. 22:352. 1821.
Helianthus macrocarpus DC. Pl. Rar. Jard. Gen. Ume. Nob. 8. 1826.
Helianthus ovatus Lehm. Ind. Sem. Hort. Hamb. 16. 1828.
Helianthus lenticularis Dougl. Bot. Reg., 1265. 1829.
Helianthus grandiflorus Wender ex. Steud. Nom. 2 ed. 737. 1841.
Helianthus aridus Rydberg, Bull. Torr. Bot. Club 32:127. 1905.

Stem: 1-4 m. tall, simple but often branched above, hispid or scabrous, often purple spotted above.

Leaves: alternate except the lowest, broadly ovate, the lower cordate, obtuse to acute, 3-nerved at base, somewhat narrowed on petiole, petiole sometimes long; dentate, finely serrate to nearly entire, coarse in texture, rough both sides, not thick, strigose-hispid, scabrous above, hispid or sometimes pubescent below, 1-3 dm. long, larger in cultivation.

Heads: solitary, in that case larger, or several smaller heads from upper axils on long stout rough peduncles, disk brown, 3-4 cm. in diameter, receptacle flat.

Involucre: flat or depressed, bracts ovate or oblong, long acuminate or aristate, hispid-ciliate, equal to the disk, sometimes longer.

Ray-flowers: numerous, bright yellow.

Disk-flowers: lobes dark brown-purple, yellow below, tube short, bulbous base of limb pubescent.

Chaff: large, oblong, acuminate, with 2 short and narrowly acute lateral cusps, purplish and pubescent at tips.

Akenes: large, oblong to obovate, striate, mostly glabrous, or slightly pubescent at summit, varied mottled to dark brown.

Pappus: 2 broadly lanceolate awns 1/3 length of the disk-flower..

Root: annual, fibrous.

Helianthus annuus is best known in its cultivated forms of which there is an increasing number of varieties, some with yellow disks and brownish-red rays. The large head atop the simple, tall, stout stem is its most outstanding feature. The "Wild Prairie Sunflower," as it is called, differs from the cultivated form in being

smaller, profusely branched, with numerous smaller heads and smaller leaves; the disk is always brown. All forms, wild and cultivated, are regarded as environmental varieties of the one species *H. annuus* L.

Variations are extremely numerous in all the grosser parts of the plant, all affected by surrounding conditions. It thrives best in rich soil, growing large and luxuriant, but it is found in all types of habitats, in poor soils responding by reduction of parts and increased harshness of surface. It blooms from July through the late summer and fall until frost.

It is said to be a native of the warmer parts of America, Peru and Mexico being given as its original home (Gray's Manual, 7th edition). The wild sunflower of the California plains probably is the ancestral type of the cultivated form. It early attained a wide distribution throughout America from California to British America because of its extensive use by the Indians. Champlain (1615) and Kahl (1794) and others saw it grown by them for food and for other uses. Today, in other parts of the world, it is used even more extensively. "In Russia, the seeds are ground into meal for tea-cakes, and the whole seeds roasted and used as coffee substitute, the oil is expressed into oil-cake for cattle food. The buds before they be flowered are boiled and eaten with butter, vinegar and pepper as artichokes and make an exceeding pleasant meat. In Germany the dried leaves are used for tobacco, the seed receptacle made into blotting paper, and the inner part into fine writing paper. The stalks yield a silky fiber of excellent quality, and the green leaves make good fodder."[1]

In Iowa, the escaped form is abundant, ranking as a troublesome weed, but the wild form also is frequent in waste places along roadsides and on prairies. It is reported from all parts of the state but seems to be more abundant in the western part.

HELIANTHUS PETIOLARIS Nutt.

Journ. Acad. Phila. 2:115. 1821.

Helianthus patens Lehm. Ind. Sem. Hort. Hamb. 8. 1828.

Helianthus integrifolius Nutt. in Trans. Am. Phil. Soc. 7:336. 1841.

Helianthus aridus Rydb. Bull. Torr. Club 32:127. 1905.

Plate XXIV

Stem: 0.3-2 m. tall or more, simple or more usually much branched and bushy from the base, very rough and hispid, stout.

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[1] See Sturdevant's Notes on edible plants. Rept. N. Y. Agri. Exp. Sta. 2, pt. 2:289. 1919.

Leaves: alternate above the lower part, variable, 3-9 cm. long, oblong-lanceolate to ovate or deltoid-lanceolate, acute, narrowly or broadly cuneate or the lower sometimes nearly cordate at the base, 3-nerved, the lateral nerves converging at the base of the blade, petioles varying in length but mostly as long or longer than the blade, the lowest leaves deeply dentate or serrate-dentate, the upper shallowly toothed or merely undulate, scabrous-hispid, more so below, grayish-green in appearance.

Heads: large and showy, 7-10 cm. broad, solitary or paniculate, terminal on main stem and upper branches, peduncles long, disk dark brown 1.5-3 cm. broad.

Involucre: bracts erect, lanceolate or oblong-lanceolate, acuminate, subulate-tipped, 8-12 mm. long, about as long as disk or a little longer, scabrous, hoary-canescent, densely hispidulus, ciliate or not.

Ray-flowers: 12-20, bright yellow, oval, about 2.5 cm. long.

Disk-flowers: 5 mm. long, slender, red or purple-brown lobes pubescent, bulbous base and short tube densely pubescent.

Chaff: large, 3-cuspidate, lateral cusps short and distant, middle cusp acute or short acuminate with purplish mucronate tip, hispid, inner ones bearded with conspicuous dense white hispidity.

Akenes: brown, 5 mm. long, oblong, thickish, rounded to truncate at summit, densely villose when young, evenly villous when mature.

Pappus: 2 lanceolate chaffy awns one half as long as the disk corollas.

Underground parts: root annual, with many fibrous branches.

This species is a close relative of *H. annuus* which it resembles in its more vigorous forms. Its identity, however, is maintained in its generally smaller size, more bushy contour, and gray-green aspect. The long-petioled arrow-shaped leaves, the conspicuous beard-like hispidity of the inner chaff, and the smaller though none-the-less handsome heads with short lighter-yellow rays also distinguish it from *H. annuus*.

It, too, is called the "Prairie Sunflower", because of its frequent appearance in prairie regions, sterile hillsides, and other arid places. The heads appear throughout August and September.

Its range is from Saskatchewan to Minnesota, Missouri, Nebraska,

Arizona, and Texas, west to Oregon, rarely naturalized eastward. Naturalized in Iowa from the western states, it is now rather common locally along roadsides, railroad beds, in arid soil along streams and in sand and gravel areas. Abundant material was collected from such areas by the writer. A luxuriant growth of these sturdy sunflowers was seen near Fruitland, Iowa, where a patch several rods wide adorned the roadsides and fields on both sides for more than a mile, excluding nearly all other vegetation.

Herbarium specimens were from the counties of Appanoose, Delaware, Iowa, Lee, Louisa, Mahaska, Union, Muscatine, and Woodbury. It is reported from the following counties: Dubuque (11), Hardin (40), Johnson (56), Linn (60), Louisa (4), Muscatine (12), Scott (4) and from the state of Iowa (17, 37).

HELIANTHUS SCABERRIMUS Ell.

Sketch. 2:423. 1824.

Helianthus rigidus (Cass.) Desf. Cat. Hort. Paris Ed. 2:184. 1829.

Plate XXV

Stem: 0.5-2 m. tall, stout, simple or sparingly branched above, rigid, scabrous, hispid with short stiff antrorse hairs from papillae, often smoother and purplish above, exudes resin in small amount.

Leaves: mostly opposite, or uppermost alternate, oval to linear-lanceolate or elliptic-lanceolate, obtuse to acute, strongly triple-nerved above the base, and narrowed to base of petiole, lowest somewhat petioled, shallowly serrate or nearly entire, upper leaves lanceolate or elliptic-lanceolate, acute, or acuminate at each end, subsessile, somewhat triple-nerved, all extremely thick, rigid and coriaceous, scabrous both sides, hispid with short antrorse bristles from papillae, often with "whitish blistered appearance."

Heads: solitary or few on long, slender, nearly naked, purple-red pedunceles, disk brown-purple, 2-3 cm. broad, receptable convex.

Involucre: high convex; bracts dark green, ovate, obtuse or acute, shorter than the disk, erect, closely appressed and imbricated in 3-4 rows, at base striate, shiny and somewhat sticky, evenly ciliate on margins to apex.

Ray-flowers: 15-25, orange-yellow, erect-divergent, 2.5-4 cm. long, mostly 2-toothed.

Disk-flowers: 1 cm. long, lobes mostly purple-brown, tube short and glabrous, the limb very pubescent on bulbous base, very slightly so on veins and lobes.

Chaff: almost as long as disk-flowers, dark at apex, obtuse, entire or with lateral cusps very small and short, ciliate on keel and apex.

Akenes: dark, oblong, thick, pubescent throughout when young, only so at the rounded summit when mature.

Pappus: 2 large broad-lanceolate concave scales rather than awns, often with small intermediate ones.

Underground parts: root perennial; rhizomes thick.

H. rigidus (Cass.) Desf. is the name which properly designates this species. *H. scaberrimus* of Elliott is known to have had the disk-flowers yellow and therefore could not have been this dark centered form. Since Gray's Manual, 7th edition, recognizes *H. scaberrimus* Ell., giving *H. rigidus* (Cass.) Desf. as a synonym, such usage is followed in this treatment.

This stout coarse species, called the "Stiff Sunflower", is easily recognized by the extremely harsh surfaces, the mostly opposite, ascending, thick, rigid, and scabrous leaves, and the brilliant dark centered heads on long slender, hirsute, reddish peduncles. It is distinguished from *H. laetiflorus* Pers. by the generally harsher surfaces, the erect, appressed, acute, shiny, ciliate bracts and the red-purple lobes of the disk corollas.

Unlimited variation is shown in the form and harshness of the leaves. A plant in the Missouri Botanical Garden herbarium was far less harsh and scabrous than the prairie individuals. Ternate-leaved forms are occasionally found.

It is common on prairies, in fields along fences and roadsides. It comes into bloom late in July, lasting through August to the middle of September.

In North America, its range is from Saskatchewan to the Rocky Mountains, to Illinois, Minnesota, Michigan, Dakota, eastern Colorado, south to Georgia and Texas. In Iowa it is common to abundant on dry ridges, roadsides and edges of fields, also in sand and gravel areas. Abundant material was secured in such localities visited. A dark green, extremely harsh plant with ternate leaves throughout was found along the railroad between Wilton and Summit, and also one on the dry ridge of a large kettle-hole in the region of Lake West Okoboji. Strong vigorous plants were found

holding their own along with other dry prairie forms, on the sand dune areas near Muscatine. Herbarium specimens are abundant. It is reported in all local, county and state lists.

HELIANTHUS LAETIFLORUS Pers.

Syn. 2:476. 1807.

Helianthus atrorubens Lam. Encyc. 3:86. 1789.
Helianthus tricuspus Ell. Sketch 2:422. 1824.

Plate XXVI

Stem: 1-1.5 m. or more tall, simple or somewhat trichotomously branched above, scabrous and reddish-purple as in *H. scaberrimus* Ell., hispid with hairs spreading, leafy throughout.

Leaves: opposite or uppermost alternate, base of petioles approximate, broadly lanceolate, acuminate, contracted at base into short petioles, or narrowed on petiole, triple-nerved, near base the veins anastomosing with these lateral nerves, serrate, very scabrous both sides, hispid-pubescent beneath, coriaceous, less thick and harsh than *H. scaberrimus*.

Heads: solitary or several on long hispid peduncles, somewhat corymbose, disk yellow.

Involucre: campanulate-cylindrical, bracts in 3 series, ovate to broad linear-lanceolate, acuminate, about as long as the disk, slightly pubescent on back or nearly smooth, cilia on margins longer toward base, not so appressed as in *H. scaberrimus*, ribbed at base.

Ray-flowers: 12-20, 2 to nearly 5 cm. long, deep yellow.

Disk-flowers: yellow, lobes rarely tinged with purple, villous-pubescent at bulbous base, tube short, glabrous.

Chaff: long, entire and acute or with 2 distant and small lateral cusps, hirsute-pubescent and purplish at apex and along keel.

Akene: somewhat compressed, entirely pubescent when young, only at the summit when mature.

Pappus: 2 subulate pubescent awns dilated at base, with one or two smaller squamellae on each side.

Underground parts: root perennial, of coarse fibers; rhizomes slender, occasionally with tubers.

This brilliant sunflower becomes very luxuriant in cultivation with longer, broader leaves and larger, more numerous heads. The whole plant is stout and coarse but showy. It grows in dry open

places, along roadsides and edges of woods. In the field it resembles *H. scaberrimus* (*H. rigidus Desf.*), and often is found near it, even co-mingled with it. Its more leafy aspect, the less scabrous nature of the stem and leaves, and the yellow flowers of the disk, distinguish it. Also the involucral bracts are more acute and not so appressed, and the leaf serratures are more constant than in *H. scaberrimus*.

Its range in America covers almost the same territory as *H. scaberrimus*, namely: Ontario to Georgia, Indiana, Illinois, Wisconsin, Minnesota, Dakota, Nebraska, Arkansas and Texas. In Iowa, it is frequent to common on prairies, roadsides and other dry places. The writer secured plants in flower and fruit by the interurban track near Iowa City, in isolated groups along roadsides east of Davenport, and also in cultivation in the city of Davenport. No doubt, it is often overlooked as a species, or in the vegetative phase classed as one of the many forms of its dark-centered neighbor.

Herbarium specimens were from the counties of Clinton, Sac, Hardin, Cerro Gordo, Fayette, Floyd, Clay, Lyon, Decatur, Emmett, Chickasaw, Cherokee, Winnebago, Kossuth, Jasper and Palo Alto. The lists for Iowa report it from the following counties: Fayette (10, 12), Iowa (51), Jackson (12, 42), Johnson (12, 42), Mitchell (59), Muscatine (4, 12), Story (12, 20) and from the state of Iowa (1, 17).

HELIANTHUS OCCIDENTALIS Ridd.

Suppl. Cat. Ohio, Pl. 13. 1836.

Helianthus heterophyllus Nutt. Journ. Acad. Phila. 7:74. 1834.
Helianthus illinoensis Gleason, Ohio Nat. 5:214. 1904.
Helianthus occidentalis var. *illinoensis* (Gleason) Gates, Bull. Torr. Club. 37:79. 1910.

Plate XXVII

Stem: 0.5-1 m. tall, erect, slender, usually simple or sparingly branched above, scabrous, somewhat hispid especially below, nearly leafless above, pale green, somewhat reddish.

Leaves: few, opposite, mostly near the base on the first few nodes, oblong-elliptic to ovate-lanceolate, 3-nerved, narrowed into long margined, ciliate petioles, approximate at base, obtuse or acutish, obscurely serrate to nearly entire, scabrous-hispid above, roughish-pubescent to hirsute beneath, upper leaves remote and bract-like.

Heads: small to medium, solitary or several on long slender reddish hispid peduncles, disk 1 cm. broad, yellow.

Involucre: bracts ovate-lanceolate, or lanceolate, acuminate, scarcely as long as the disk, loose, subpubescent or nearly glabrous, margins longer ciliate toward base.

Ray-flowers: 11-17, bright yellow, 1-2 cm. long, acute or 2-toothed.

Disk-flowers: yellow, 4 mm. long, lobes spreading and glabrous, limb cylindrical, fine-pubescent below, and on very short tube.

Chaff: nearly as long as the disk-flower, acute, somewhat 3-cuspidate, slightly pubescent at apex.

Akene: brown, angled, truncate, pubescent toward summit and very much so along the two main angles when young.

Pappus: 2 lanceolate subulate awns, occasionally with 2 shorter ones.

Underground parts: root perennial.

This dainty "Few-leaved Sunflower" is a very distinct species, easily recognized in the field by its slender reddish wand-like and nearly leafless stem, and the small bright yellow heads on long peduncles. Variations are found in the height of the stem and the extent of its pubescence, the distribution of the leaves upon the stem, and the infinite variety of their form, size, and the length of the petiole. Plants observed growing in rich moist soil in Missouri Botanical Garden were only slighty scabrous and the leaves were much larger than any found on plants in the field.

The variety *Dowellianus* (Curtis) T. & G., reported for Illinois, differs from the species in being taller, more robust, more branched and leafy above, merely appressed-pubescent, the leaves larger and broader, and the heads more numerous.

These plants are typical of the prairie, dry soil of barrens, and sand areas. They bloom through August and September.

In the United States, *H. occidentalis* has become established in the District of Columbia and on the New Jersey Coast; it is distributed from Michigan, Minnesota, Ohio, southwest to Missouri, Kentucky, Florida, and Texas. In Iowa it is frequent to common in the eastern part in dry open places, sandy copses and in pure sand and gravel areas, the patches often widely separated. Large colonies of this attractive little sunflower were encountered by the writer at Cou Falls and along the interurban track near Iowa City; specimens were gathered from isolated groups along a railroad track southeast of Iowa City; scattered individuals were found dotting a sandy field and wayside in the vicinity of the sand mounds in

Muscatine County; a small plant bearing a solitary head was found on the hard dusty roadside near McCausland. Herbarium specimens were from the counties of Lee, Fayette, Allamakee, Clayton, Delaware, Muscatine, and Winneshiek. It is reported from the following counties: Benton (12), Clinton (12), Emmett (30), Fayette (10, 12, 15), Henry (12, 49), Johnson (11, 12, 49, 56), Lee (12), Linn (53), Lyon (45), Muscatine (4, 12, 49), Scott (4, 26), Winneshiek (11) and from the state of Iowa (9, 17, 52).

Helianthus mollis Lam.

Encyl. 3:85. 1789.

Helianthus pubescens Vahl. Sym. Bot. 2:92. 1794.
Helianthus canescens Michx. Fl. Bor. Am. 2:140. 1803.

Plate XXVIII

Stem: 0.5-1 m. tall, simple, often tufted, with erect or ascending branches, very stiff and firm, when young villous throughout, in age often hirsute and hispid, somewhat smoother below, leafy throughout.

Leaves: opposite, or the upper alternate, ascending, ovate to ovate-lanceolate, 5-15 cm. long, with a broad, sessile, somewhat cordate clasping base, acute, nearly entire or serrate-crenate with small teeth, both surfaces canescent, the upper slightly scabrous, the lower very soft and velvety, grayish-green, 3-nerved above the base.

Heads: solitary or few, racemose on short stout peduncles, showy, 5-7 cm. broad, disk about 2 cm. wide, yellow.

Involucre: hemispheric, bracts oblong-lanceolate, or with lanceolate tips, 1-1.5 cm. long, bristly villous-canescent, the outer somewhat unequal, erect to squarrose, about equalling the disk.

Ray-flowers: 15-21, bright yellow, 2-3 cm. long, pubescent at base and along veins on under side.

Disk-flowers: yellow, tube short, limb cylindrical, base and corolla lobes canescent.

Chaff: 9 mm. long, linear, almost entire or rarely 2 small lateral cusps, canescent at the summit and on the keel.

Akene: pubescent at summit when young, nearly glabrous when mature.

Pappus: 2 lanceolate, chaffy, fringy awns.

Underground parts: root perennial, with many fine rootlets;

rhizomes short, thick; crown buds at base of stem late in the season.

This strikingly handsome sunflower is easily recognized by its extreme canescent gray-green appearance, the sessile, clasping leaves, especially the tufted ascending branches and the large erect showy heads on short stout, stiff peduncles. From this canescent form, it grades into less woolly, greener and even scabrous variants which approach its near relatives *H. doronicoides* Lam. and *H. tomentosus* Michx.

In the wild, it thrives in dry wooded areas and in open barren ground. It responds to cultivation, but becomes coarse and weedy and not so desirable. The blossoms appear throughout August and September.

Its range in the United States is from New York to Ohio, Indiana, Kansas, Missouri, south to Georgia and Texas. Specimens were examined from Shaw's Gardens, St. Louis. Herbarium specimens were from Muscatine and near Duck Creek, Davenport. Father Hauber loaned good herbarium specimens from the St. Ambrose College grounds. In August, 1933, a thriving group of this species was discovered among the sumac at the roadside in Duck Creek Park, Davenport. Here, late in the fall, the writer secured several specimens, each with two or three dark red crown-buds. In 1934, only a few plants of this species were to be found at this spot, probably due to the dry summer of that year.

It is reported as belonging to the flora of Iowa by J. C. Arthur (1), and T. J. Fitzpatrick (12), from Johnson County by M. P. Somes (56), and from Linn County by E. D. Verink (60).

Helianthus grosseserratus Martens

Sel. Sem. Hort. Lov. ex. Linnaea 14. Litt. 133. 1840.

Stem: 1-3 or 4 m. tall, simple, branched above, very smooth, sulcate, almost always purplish and with whitish bloom, the upper branches strigose-pubescent, leafy throughout.

Leaves: opposite below, alternate above, or sometimes opposite throughout, lanceolate or oblong-lanceolate, long acuminate, sharply and coarsely serrate or sometimes saliently so, the uppermost denticulate or nearly entire, mostly obtuse at the base, slender and short-petiolate, slightly though not noticeably triple-nerved, thinnish, scabrous above, tomentose-canescent be-

neath; large leaves may be 1-2 dm. or more long with petioles 2.5-5 cm. long, narrowed about ½ way to base of petiole.

Heads: few to numerous, racemose, cymose or panicled on short slender scabrous-villous peduncles, showy, the disk yellow, 1.5-2 cm. broad, receptacle convex.

Involucre: hemispheric, bracts subulate-lanceolate or oblong, or cuneate with lanceolate tip, loose-attenuate, longer than the disk, unequal, mostly glabrous, somewhat ciliate toward base and tip.

Ray-flowers: 10-20, bright yellow, 2-4 cm. long, apex acute, oblong, concave.

Disk-flowers: 4 mm. long, yellow, slender with short tube and bulbous base, lobes mostly glabrous, base pubescent.

Chaff: linear-oblong, acute, entire or barely 3-cuspidate, dark green and pubescent at the summit.

Akene: brown, oblong or narrower, nearly glabrous, striate.

Pappus: 2 short lanceolate awns.

Underground parts: root, perennial, with fine rootlets; rhizomes many, long, branched.

A typical form of this species is easily recognized by the tall very smooth stem, purplish and with whitish bloom, the strigose-pubescent upper branches, leafy throughout, the coarsely serrate lower leaves whitish canescent below, the smooth loosely attenuate bracts of the involucre, and the dark brown glabrous akene. Variations in size are very great, plants sometimes becoming gigantic and the stem stout and woody. A plant found by the roadside in Muscatine County stood over twelve feet tall, with the lower leaves a foot long. Other variations are found in the leaf arrangement and serratures of the margins. The heads vary in size and are often numerous and luxuriant. The smaller leaved forms seem to approach *H. giganteus* L. but they are distinguished from it by the smooth glaucous stem and canescent under surface of the leaf. It is also closely related to *H. Maximiliani* Schrad., but it does not have the rough hispid stem and alternate leaves with serrulate or entire margins and the frequent conduplicate habit which readily distinguish the latter species.

Helianthus grosseserratus grows in dry soil of plains and prairies, along streams, becoming most luxuriant in low moist places. It begins to bloom in August reaching its maturer stages in September.

It is widely distributed over the United States from Long Island

and Maine west to Ohio, Minnesota, Dakota, Colorado, south to Missouri, western Louisiana and Texas. In Iowa it is so abundant and prolific in low grounds, uncultivated fields, and open wooded tracts that it is listed among the troublesome weeds.

It is included in all local, county, and state lists.

HELIANTHUS GIGANTEUS L.

Sp. pl. 905. 1753.

Helianthus altissimus L. sp. pl. ed. 2:1278. 1762.
Helianthus gigas Michx. Fl. N. Am. 2:141. 1803.
Helianthus virgatus Lam. Encycl. 3:85. 1829.
Helianthus crinitus Steud. Nomen. 2 ed. 1:737. 1841.
Helianthus tuberosus Parry, Owen, Rep. Minn. Surv. 615. 1849.

Plate XXIX

Stem: 1-3 m. tall, simple, rather stout, scabrous, hispidulous above, sometimes glabrous below, often purplish, branched only above.

Leaves: alternate, or opposite below, or scattered, lanceolate to linear-lanceolate or oblong, 10-20 cm. long, acuminate, serrate, dentate, or nearly entire, slightly 3-nerved at base, narrowed into subsessile somewhat ciliate bases, dark green both sides, more scabrous above, pilose-scabrous below, the pubescence not dense but of scattered spreading hairs, more pronounced on the veins.

Heads: showy, 1-2 cm. broad, somewhat corymbose-paniculate, disk yellow, receptacle slightly convex.

Involucre: hemispheric, bracts lanceolate, or elliptic-lanceolate, 8-13 mm. long, acuminate, longer than the disk, hairy or strongly spreading villous-ciliate on the margins, loose-attenuate or squarrose.

Ray-flowers: 10-20, light yellow, 1-2 cm. long, oval.

Disk-flowers: 5 mm. long, yellow, tube short, slightly pubescent at base and on lobes.

Chaff: 7 mm. long, oblong, entire or slightly 3-cuspidate, acute, pubescent at apex and along the keel.

Akene: about 5 mm. long, cuneate-oblong, glabrous.

Pappus: 2 short, lanceolate-subulate awns or scales, slightly fringed or chaffy.

Underground parts: root perennial; crown buds; often short fleshy edible tubers.

This species approaches *H. grosseserratus* Martens, but it does

not grow so large and differs otherwise in being rather stout, scabrous or hispidulous, the leaves mostly alternate or scattered, not canescent below, opposite only in unfavorable habitats, the bases 3-nerved, subsessile, and ciliate.

It has a more limited habitat than *H. grosseserratus*, being strictly a species of low ground such as swamps, borders of marshes, wet meadows, low thickets and copses. It blossoms through August and September.

In North America, this species is distributed from Ontario to Manitoba and the regions of the Rockies; eastward, it is found in Maine, New York, New Jersey, Virginia; southward it is said to be found in Louisiana and Texas, although by some it is claimed not to exist south of the Missouri line. In Iowa, it is rare to frequent in open woodlands, borders of marshes, and other moist ground.

The verified specimens examined were from Missouri Botanical Garden. Iowa specimens in the herbaria were from Allamakee, Hamilton, and Muscatine Counties.

It is reported, somewhat doubtfully, from counties as follows: Fayette (10, 14, 15), Linn (60), Muscatine (4), Scott (4), Story (23) and from the state of Iowa (12, 17).

Helianthus Maximiliani Schrad.

Ind. Sem. Hort. Götting. 1835.

Helianthus subtuberosus Bourg. ex. Gray Syn. Fl. N. Am. 1803.

Plate XXX

Stem: 1-3 m. tall, stout, usually branching above, often simple, sometimes tufted, branches ascending, leafy throughout, internodes short, appressed scabrous-hispidulous, somewhat smooth toward base.

Leaves: mostly alternate, sometimes opposite in reduced forms, lanceolate, linear, or oblong-lanceolate, 10-15 cm. long, 1-2 cm. broad, acuminate at both ends, the lower leaves narrowed to the base of petiole, upper leaves with narrowed sessile bases, entire or denticulate, not noticeably 3-nerved, very scabrous and often canescent and strigose on both sides, gray-green, becoming rigid, falcate and conduplicate, a peculiar habit not true of any other Iowa sunflower.

Heads: showy, numerous, terminal on stem and on short, densely

rough-pubescent peduncles from upper axils, disk 1.5-3 cm. broad, yellow.

Involucre: flat, bracts linear to lanceolate, 1.5-2.5 cm. long, attenuate into long slender tips, much longer than the disk, conspicuously gray strigose-canescent, loose and spreading.

Ray-flowers: 15-30, golden yellow, 2-4 cm. long, very concave.

Disk-flowers: 5.5 mm. long, dull yellow, slender, tube short, pubescent only along the veins of the corolla limb.

Chaff: 6-8 mm. long, linear, acute, very pubescent at apex and along keel.

Akene: brown, 4-5 mm. long, linear-oblong, striate, glabrous.

Pappus: 2 lanceolate short chaffy scales, frequently with 2 intermediate more rounded ones.

Underground parts: root, perennial with numerous thick woody branches; rhizomes short; crown buds at base of stem (Plate XXX, Fig. 4).

The variations in this species have to do mainly with the size of the plant. The dwarf few-flowered forms with simple low stem found in difficult surroundings are in striking contrast to the tall, more robust, many-flowered individuals of favorable environments. In cultivation it thrives, becoming an ornamental plant of distinctive character with larger and less conduplicate leaves. In the native haunts, when the falcate and conduplicate phase of the leaf is pronounced, the plants have a forlorn, wind-blown aspect, and give the impression of suffering from water loss.

It is distinguished from its near relatives *H. giganteus*, and *H. grosseserratus* by its gray appearance, the harsh conduplicate leaves, the rough-pubescent peduncles from the upper axils, the short internodes, and the more numerous, cupped ray-flowers.

H. Maximiliani was named after Maximilian Philip, Prince of Neuwied, who in the early nineteenth century travelled in Brazil and North America in the interest of natural science.

In North America, it ranges from Saskatchewan and Manitoba to Minnesota, Nebraska and Texas. It was first reported in Iowa in the northwestern part, though previously not known north of Lawrence, Kansas. In 1882, its known eastern limit was somewhat west of Des Moines. Its present distribution is more extended, having reached the southeastern part of the state (Pammel, 29). The writer secured plants of this species from railroad right-of-ways, roadsides in Dickinson County and from low places in Mus-

catine County. Herbarium specimens were from the counties of Madison, Lyon, Woodbury, Dickinson, Emmett, Scott, Fremont, Cherokee, Floyd, Carroll, Greene, Delaware and Cerro Gordo.

It is reported from the following counties: Buena Vista (12), Dickinson (12, 51), Dubuque (11, 12), Emmett (6, 12, 30, 49), Fayette (10, 15), Floyd (12, 42), Harrison (48), Johnson (56), Linn (60), Lyon (12, 45, 49, 51), Woodbury (12) and from the state of Iowa (17).

Helianthus hirsutus Raf.

Ann. Nat. 14. 1820.

Helianthus diversifolius Ell. Sketch 2:423. 1824.
Helianthus hispidulus Ell. l.c. 419. 1824.
Helianthus tracyphyllus T. & G. Fl. N. Am. 2:239. 1842.

Plate XXXI

Stem: 0.5-1.5 m. tall, simple or sometimes branching dichotomously above, rough-hirsute or hispid, somewhat glabrous below, rigid.

Leaves: opposite, ovate-lanceolate, acuminate, triple-nerved, nerves converging near base of blade, rounded, obtuse, or subcordate at base and subsessile or distinctly but short-petioled, margin sparsely serrate or slightly denticulate, usually firm, becoming rigid, scabrous, strumose and hispid above, hirsute-pubescent beneath.

Heads: solitary or many, cymosed, showy, disk yellow, 1.5-2 cm. broad, receptacle low-convex.

Involucre: hemispheric, bracts linear-lanceolate or oblong-lanceolate equalling the disk or not much exceeding it, loose, spreading, with acuminate recurved tips, puberulent over surface, hispidulous or short-ciliate on margins.

Ray-flowers: 1.5-2.5 cm. long, oval, yellow.

Disk-flowers: 5 mm. long, yellow, cylindrical, tube short, pubescent at base and on veins of limb and on the lobes.

Chaff: somewhat obtuse, lateral cusps short, pubescent at summit and along keel.

Akene: dark brown, 4 mm. long, thickish, obovate, entirely glabrous.

Pappus: 2 short-subulate awns, one-half as long as disk-flower, no other scales.

Underground parts: root perennial, woody; rhizomes clustered, stout.

This "Stiff-haired Sunflower" has been called polymorphous be-

cause of the extensive variation and lack of resemblance shown among the individuals of the species; the plants also change from youth to age, becoming more and more stiff and hirsute of stem and the leaf more harsh and firm. Two specimens, collector unnamed, which were examined in the herbarium of the Missouri Botanical Garden were of this stiff bristly-hairy nature with opposite, sessile, subsessile, or short-petioled leaves, 3-nerved, ovate, acuminate, slightly serrate, very rough above and rough-hairy beneath. The bracts of the involucre were ovate-lanceolate, equalling or shorter than the disk, erect and slightly spreading, densely villous-canescent. The rays numbered 10-12, the disk-flowers were yellow, pubescent, the akenes were oval, rounded at summit, glabrous.

It grows in dry soil, mostly on prairies and sunny banks, coming into bloom in August.

It is distributed from Ohio and Indiana to Wisconsin, south to Virginia, West Virginia, Tennessee, Louisiana, and Texas, and said to be adventive but not established eastward.

In Iowa it is a frequent prairie plant, rather common in dry thickets, on wooded bluffs, and along roadsides. The writer secured specimens from roadsides in Scott and Muscatine Counties.

Herbarium specimens were from Lee and Louisa Counties.

It is reported from the following counties: Appanoose (13), Decatur (13), Des Moines (12), Fayette (12, 15), Harrison (48), Johnson (12), Lee (12), Monona (48), Muscatine (4), Ringgold (12), Scott (4, 26), Van Buren (12, 13), and from the state of Iowa (17).

Helianthus divaricatus L.

Sp. pl. :906. 1753.

Helianthus truncatus Schwein. Ell. Sketch 2:416. 1824.

Plate XXXII

Stem: 0.5-2 m. or more tall, slender, simple or with dichotomous or trichotomous upper branches, mostly glabrous, often glaucous and purplish and sparsely hispid above and on flower branches.

Leaves: opposite throughout, spreading, ovate-lanceolate, occasionally narrower, acute or acuminate, rounded or truncate at base, 3-nerved at base of blade, sessile or subsessile or very short

petiolate, thickish, rough on both sides, or scabrous-pubescent below, hairs on veins ascending, deep green in sunny places, paler in the shade, not thin, crisp when dry.

Heads: few, often 3 in cymose form, or several somewhat panicled, disk 1-1.5 cm. broad.

Involucre: hemispheric, bracts 10-12 cm. long, lanceolate, or oblong-lanceolate from a broad base, acuminate, equalling the disk, at length squarrose and reflexed, 3-nerved, smooth or slightly pubescent, margin ciliate toward base.

Ray-flowers: 8-12, bright yellow, 2-2.5 cm. long, narrow.

Disk-flowers: 6-7 mm. long, yellow, tube short, lobes mostly glabrous, the very bulbous base pubescent.

Chaff: 7-8 mm. long, acute, or short acuminate, with 2 short, broad lateral cusps, keeled, pubescent at tip.

Akene: 4-5 mm. long, obovate, thickish, striate, glabrous.

Pappus: 2 short-subulate ciliate awns.

Underground parts: root perennial, of coarse fibers; rhizomes many.

This species is quite constant in its smooth stem, opposite, divaricate, sessile or nearly sessile leaves, with spreading pubescence below, the two or three heads on short peduncles in upper axils. Torrey and Gray[2] call it a polymorphous form, indicating its variability. Specimens in the herbarium of the Missouri Botanical Garden include a number designated as *H. divaricatus* L., which are short-petioled. Two plants collectd by George Engelmann have truly sessile leaves partly clasping, a specimen collected by E. Durand has leaves with truncate base and short petioles. The writer found no plants in the field with really sessile leaves, though in other respects they conformed to the type.

It is a plant of the dry soil of thickets and open woods. Coming into bloom in July and August it is the earliest of the sunflowers to reach maturity.

Its range is from Northwest Territory to New England, south to the Carolinas, Florida, and Louisiana. In Iowa it is common in dry thickets and edges of woods, where its showy heads look out during July, August and September. Herbarium specimens examined were from Madison, Union, Cerro Gordo, Des Moines, Allamakee, Fayette, and Winneshiek Counties.

It is reported from all parts of the state.

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2 Torrey, John and Asa Gray. A Flora of North America. 2:295. 1840.

Helianthus strumosus L.

Sp. pl. 905. 1753.

Helianthus laevis Walt. Fl. Carol. 215. 1788.
Helianthus mollis Willd. Sp. pl. 3:2240. 1804.
Helianthus macrophyllus Willd. Hort. Berol. t. 70. 1806.
Helianthus decapetalus Darl. Fl. Cest. ed. 2:483. 1826.
Helianthus altissimus DC. Prodr. 5:590. 1834.
Helianthus strumosus var. *mollis* T. & G. Fl. N. Am. 2:327. 1842.
Helianthus neglectus Otto ex. A. Gray, Syn. Fl. N. Am. 2:279. 1849.

Plate XXXIII

Stem: 0.6-2 m. or more tall, round, slender, very smooth and glaucous below, purplish and sparsely hispid above.

Leaves: opposite, ovate-lanceolate, acuminate, 7-16 cm. long, 2-5 cm. broad, triple-nerved near the acute or rounded base, abruptly contracted at base and narrowed about half way to base of short petiole, petiole 0.5-1.5 cm. long, serrate, with small appressed teeth, rough strumose above, lower surface whitish, softly and evenly pubescent, hairs ascending.

Heads: solitary, or three to several, cymose on short peduncles from upper axils, disk 1-1.5 cm. broad, yellow, receptacle low convex.

Involucre: hemispheric, bracts broadly lanceolate, acuminate, equalling the disk, tips spreading, pubescent, ciliate on margins, strongly so toward base.

Ray-flowers: 12-15, bright yellow, 3-4 cm. long.

Disk-flowers: yellow, 5 mm. long, tube short, pubescent on bulbous base, veins and lobes.

Chaff: 8 mm. long, 3-cuspidate, middle cusp short acuminate, lateral cusps small, hairy-pubescent at summit.

Akenes: 3 mm. long, oblong or obovate, subcompressed, nearly glabrous or slightly pubescent at summit.

Pappus: 2 slender sub-chaffy awns nearly as long as the akenes.

Underground parts: root perennial, much branched; rhizomes.

Variations in this species are found in the size, texture of the leaves and the extent of the pubescence of the under surface. This under surface may be a lead-gray color, nearly white, or glabrous except for minute scattered hairs on the veins. Its constant characters are smooth stem, strictly opposite leaves and the one head, or a few heads in a cyme. It is distinguished from *H. decapetalus* L. and *H. trachelüfolius* Mill. by the bright leaves not membranous, the appressed-serrate margin, the strumose upper surface, the

whitish under surface, the broadly lanceolate bracts not exceeding the disk, and the akene pubescent at summit especially when young.

Helianthus strumosus is a dry woods species and is found also in thickets and copses. It blooms in August and September.

Its range extends from Maine to Ontario, northwest, southward to Missouri and Arkansas, and eastward to New Jersey and Virginia. In Iowa, it is widely distributed, common in woods and thickets. Plants were secured in these favored habitats in Dickinson, Muscatine, Johnson, and Scott Counties.

It is reported from the following counties: Dubuque (38), Emmett (7), Fayette (10, 15), Hardin (40), Harrison (48), Johnson (13), Madison (25), Mitchell (59), Monona (48), Muscatine (4), Scott (4), Story (20), Winneshiek (46) and from the state of Iowa (17).

HELIANTHUS DECAPETALUS L.

Sp. pl. 905. 1753.

Helianthus multiflorus L. Sp. pl. 905. 1753.
Helianthus frondosus L. Amoen. Acad. 4:290. 1759.
Helianthus strumosus Willd. Sp. pl. 3:2242. 1804.
Helianthus grandiflorus Juss. ex. Pers. Syn. 2:475. 1807.
Helianthus tenuifolius Ell. Sketch 2:420. 1824.
Helianthus scrophulariaefolius Britton Man. Fl. U. S. 1901.

Plate XXXIV

Stem: 1-2 m. tall, slender, simple but branching above, striate, green and smooth below, upper branches sometimes purplish and pubescent.

Leaves: opposite, upper sometimes alternate, oblong, ovate or sometimes cuneate at base, abruptly contracted into a somewhat winged or nearly naked petiole, triple-nerved above the base, long-acuminate, coarsely and sharply serrate, green both sides, scabrous above with very short stiff hairs often scattered, smooth or scabrous beneath, never pubescent, very thin and membranous, especially so in the pressed plant.

Heads: solitary or numerous on upper leafy branches; peduncles hispid, fastigiate, showy, disk rather small, yellow.

Involucre: somewhat companulate, bracts narrowly lanceolate-linear, loose, spreading but not reflexed, outer often longer than the disk, thin, often foliar, glabrous or slightly pubescent, very short ciliate on margins.

Ray-flowers: 8-12, light yellow, 2.6 cm. long, pubescent below on the orange colored veins.

Disk-flowers: yellow, tubular, slightly bulbous above the short tube, pubescent or puberulent throughout, especially on lobes and base.

Chaff: short, 3-cuspidate, the two lateral cusps small, acuminate, pubescent at apex and on keel.

Akene: brown, glabrous, somewhat appressed, ovate-oblong.

Pappus: 2 short slender subulate awns.

Underground parts: root perennial, of coarse fibers; rhizomes long, stout.

The variations in this species are found mostly in the size and texture of the leaf. When found growing in shady places the leaves become very large and broad with longer petioles, and very smooth lower surfaces. The outer involucral bracts are quite variable, sometimes becoming long and foliaceous; the rays are seldom ten in number, as *decapetalus* implies, more often there are twelve.

It is called the "Thin-leaved Sunflower" in contrast to *H. divaricatus* L. and *H. strumosus* L., whose leaves are thicker and more rough. Also, the large serratures, the more distinct petiole, the green under surface of the leaves, the longer, spreading bracts of the involucre and the entirely smooth akene separate it from these near relatives.

It is found in woods, copses and on shady banks along streams. It comes into bloom in August and September and is one of our most beautiful sunflowers. It has been long under cultivation as "Soleil d'Or".

Its distribution is from New England west to Michigan, Illinois, Kentucky, and Georgia. In Iowa, it is frequent, growing large and luxuriant in its favored haunts. The writer secured fine specimens with very large, thin, coarsely serrate leaves at the edge of a moist woods near the Little Sioux River in Dickinson County.

Herbarium specimens were from the counties of Lyon, Winneshiek, Lee, Emmett, Allamakee, Woodbury, Dubuque, Cerro Gordo, Iowa, Muscatine, and Louisa. It is reported from the following counties: Dickinson (51), Floyd (12), Johnson (56), Linn (60), Lyon (5), Madison (25), Muscatine (4), Scott (4), Webster (27), Winneshiek (46) and from the state of Iowa (17).

HELIANTHUS TRACHELIIFOLIUS Mill.

Gard. Dict. 8 ed, No. 7. 1768.

Helianthus prostratus Willd. Sp. pl., ed. 4, 3:2242. 1797.

Plate XXXV

Stem: 1-1.5 m. tall, erect, slender and simple, branched above, smooth toward base, pubescent above, in age rough with old hair bases.

Leaves: opposite, or alternate above, 8-15 cm. long, broadly lanceolate, never ovate, long acuminate, lower sharply and coarsely serrate or dentate, thin, nearly equally green on both sides, scabrous above, more or less pubescent or rough-haired below, triple-nerved, lateral nerves short, abruptly narrowed into distinct short petioles which are ciliate.

Heads: showy, 6.5-8 cm. broad, in loose racemose or cymose panicles, disk 1.5 cm. broad, yellow.

Involucre: campanulate, bracts lanceolate-linear, attenuate, longer than the disk, the exterior ones often extended into long subulate squarrose appendages, all loose and spreading, ciliate on margins, slightly so on surface, bases striate.

Ray-flowers: 10-15, light yellow, 3-4 cm. long, oval, pubescent along veins on under side.

Disk-flowers: about 5 mm. long, pubescent throughout or on base and lobes, slender and tapering.

Chaff: entire or barely 3-cuspidate, straw color below, grayish to blackish above, villous at apex and on keel.

Akene: dark, obovate, slightly truncate, glabrous.

Pappus: 2 broad, short, subulate awns.

Underground parts: root perennial, many fibers; rhizomes branched.

The specimen chosen for the foregoing description was loaned by the Field Museum Herbarium, and was collected by R. E. Means near Camp Douglas, Wis., Aug. 1890. Other plants designated as *H. tracheliifolius* were from the Missouri Botanical Garden and Iowa State College, Ames, Iowa.

The species closely resembles *H. strumosus* L. and also *H. decapetalus* L. and has been mentioned as a possible hybrid of these two strong species. It is a smaller form, distinguished by the thin leaves equally green on both sides, short though distinctly petioled and sharply serrate, and the bracts all loosely spreading, exceeding the disk and often elongated.

The habitat, like that of *H. strumosus,* is in dry thickets and edges of woods. It comes into bloom in August and continues through September.

It is distributed from Pennsylvania to Wisconsin, Missouri, and Arkansas. In Iowa it is said to be rare, infrequent or doubtful in low thickets and borders of woods.

Plants identified as this species were collected by the writer from open wooded hillsides, City Park, Cedar Rapids, Iowa. They possessed the almost strictly opposite leaves equally green on both sides, abruptly narrowed into short ciliate petioles, and the very striking long, loose and spreading outer involucral bracts. The underground parts, not present in any herbarium specimens seen, consisted of many fibers and several long branching rhizomes.

The species is reported from the following counties: Fayette (10, 12, 15), Henry (23), Johnson (12, 56), Muscatine (4), Story (12, 20) and from the state of Iowa (17).

Helianthus tuberosus L.

Sp. pl. 905. 1753.

Helianthus doronicoides T. & G. Fl. N. Amer. 2:327. 1841, in part not Lam.
Helianthus esculentus Warcz. Allg. Gartenz. 20:293. 1852.

Stem: 1.5-2.5 m. tall, stout, usually branched above, striate, scabrous and hirsute, less so near base.

Leaves: alternate, or frequently opposite below, 10-20 cm. long, commonly broad-ovate to ovate-lanceolate, lower often subcordate, acuminate, 3-nerved near base of blade, cuneate or narrowed abruptly into winged petioles 4-10 cm. long, with wings often obscure, shallowly serrate or somewhat dentate, thinnish, not coarse, nor yet membranous, green above, and firm scabrous-setose, lower surface somewhat densely spreading hispid-pubescent, not rough to the touch.

Heads: numerous and showy, panicled, disk 1.1-5 cm. broad, yellow, receptacle convex.

Involucre: hemispheric to campanulate, bracts linear to linear-lanceolate, variable, long-attenuate, loose and often squarrose, rather foliaceous, appressed-pubescent, long-ciliate or hirsute on margins toward base, a little (or much) longer than the disk, inner bracts dark purple toward base.

Ray-flowers: 12-20, bright yellow, 2.5-4 cm. long, tips obtuse, 1 cm. broad.

Disk-flowers: 5-7 mm. long, yellow, cylindrical, very pubescent at base, slightly so on lobes and main veins, barely bulged above the short tube.

Chaff: rather long, acute or slightly acuminate, often with 2 distant acute lateral cusps, long ciliate at tip and on keel.

Akene: 5-6 mm. long, dark brown, thick, angled, oblong, pubescent at summit and on angles.

Pappus: 2 subulate scales or chaffy awns about one-half the length of the disk corolla, rarely one or two intermediate fringy scales.

Underground parts: root perennial, of coarse fibers; rhizomes numerous, slender, bearing large edible tubers.

A number of specimens were used for the verification of this species in Iowa. One, loaned by the Field Museum Herbarium, was from the herbarium of J. T. Ruttnock, and found in moist ground, West Chester, Pennsylvania; others examined were from the herbarium of the Missouri Botanical Garden. Iowa specimens were loaned by Father Hauber of St. Ambrose College, Davenport, R. I. Cratty of the Iowa State College, Ames. Dr. Henry S. Conard of Grinnell College loaned specimens with tubers.

Variations are found chiefly in the leaves—their shapes, texture, serratures, and length of petiole. The pubescence of the under surface of leaves in some forms is so pronounced as to give rise to the variety *sub-canescens* Gray. This variety differs in many respects from the species and is readily recognized as something different. Plants found in Iowa herbaria and in the field are very constant in the following distinctions: usually smaller, very stiff and rigid, mostly simple, often bearing only one flower head, leaves more strictly opposite, thicker and coarser, lower ones large with coarse serratures, lower surface softly and densely canescent, involucral bracts very dark. A description typical of this varietal form will further aid in their recognition. (Page 367). Ternate forms are occasionally found. "A remarkable teratological form of this species with stem-leaves in whorls of three was collected in Wapello County, Sept. 3, 1929, by Dr. J. M. Aikman and the writer."[3] The plants do not always produce tubers, and only late in the fall do these form on the slender rhizomes. In cultivation, the entire plant is more luxuriant, producing many and much larger tubers.

Its native haunts are along fence rows, in old fields, along streams

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[3] Cratty, R. I. Iowa Plant Notes IV. Proc. Ia. Acad. Sci. 37:89. 1930.

in alluvial or almost any soil. It flowers from late August to middle October or until frost.

Probably introduced into North America from Brazil, it was long cultivated by the aborigines. Its cultivation and use as an article of food brought about its wide distribution over the whole of the United States and southern Canada, and it has had a long and interesting history connected with that of the early peoples and with the colonial development of our country. Gray and Trumbell[4] give an authentic account of its association with man from early times.

Many local names designate this species, such as Tuberous Helianthus, Earth Apple, Canada Potato, Girasole, Topinambour, and Jerusalem Artichoke. This last name probably is a corruption of the Italian *Girasoli articocco* (Sunflower Artichoke). From 1616 to 1753, it had fifteen botanical synonyms, when Linnaeus, in this latter year, called it *Helianthus tuberosus.*

Dr. A. Gray[5] believes that this edible sunflower originated in the Mississippi Valley from *H. doronicoides* Lam., a coarse species with showy heads which is said to grow in river bottoms from Ohio to Illinois and southward.

H. tuberosus is distributed from Nova Scotia, New Brunswick, Quebec and Ontario southward to New York, New Jersey, Pennsylvania, Georgia, Minnesota, Missouri, Nebraska, Arkansas and westward. In Iowa, it has a wide distribution and also has become naturalized from gardens. It is frequent in low moist ground, low woods, abundant in open places, borders of woods and fields, and is reported as found on new levees and in sand and gravel areas. Abundant material was taken from fence rows in Dickinson County, along Duck Creek near Davenport, roadsides and open places in Scott County. In late September, 1933, the writer secured from the garden of Mr. J. M. Hitchings, Davenport, very large, splendid specimens of *H. tuberosus.* They ranged from 2-5 m. in height, were mostly simple, but ramosely branched above, and bore several to many medium sized heads on slender branches from the upper axils. The leaves were quite typical of the species, being mostly alternate except below. Each plant produced many tubers of various sizes

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[4] Gray, A. and J. H. Trumbell. Review of De Candolle's Origin of Cultivated Plants, with annotations on certain American species. Amer. Jour. Sci. 26:128-138. 1883.

[5] Gray, A. The Jerusalem artichoke once more. Amer. Agri. 36:142. 1877.

and shapes and these were quite edible. Herbarium specimens were from many localities in all parts of the state.

It is reported in all county and state lists.

Helianthus tuberosus var. subcanescens Gray

Syn. Fl. N.A. 1(2):280. 1884.

Helianthus subcanescens (Gray) Watson. Rep. Mich. Acad. Sci., Arts and Letters. 9:430. 1928.

Helianthus mollissimus Watson. Rep. Mich. Acad. Sci., Arts and Letters. 9:432. 1928.

Stem: 1.1 m. tall, stout, stiff and rigid, stramineous, densely scabrous-hispid, simple, leafy to the top.

Leaves: strictly opposite, ovate below to linear-lanceolate above, acute or some acuminate, narrowed to base of petiole or petiole almost distinct, margin coarsely, evenly serrate on lower leaves, serrulate to nearly entire above, 3-nerved above the base, upper surface antrorse strumose-hispid, lower surface densely soft strigose-canescent giving whitish appearance.

Heads: solitary to few, cymose, peduncles short.

Involucre: campanulate, bracts narrow linear-lanceolate, attenuate, some longer than disk, erect, loose, later reflexed, dark green, hispidulous only toward apex, ciliate on margins.

Ray-flowers: 15, with orange veins, pubescent on back, 2 cm. long.

Disk-flowers: yellow, cylindrical, slightly pubescent on lobes and veins, densely so on base.

Chaff: tricuspid, lateral cusps small, apex acute, canescent on tips and keel.

Akene: linear, brown, flattened though slightly angled, canescent at summit and somewhat down the angles.

Pappus: 2 slender chaffy awns with enlarged bases, 1/2 as long as disk-flower.

Underground parts: root perennial, fibrous; rhizomes bearing tubers.

Watson raises this more canescent form of *Helianthus tuberosus* to the species rank because of "the invariably opposite leaves of thick coarse texture with densely pubescent under surface." His *H. mollissimus*, synonymous with var. *subcanescens* Gray, has narrower, more attenuate bracts, not dark green, but almost hoary with dense hispidity, the inflorescence more ample, rays longer, disk-flowers glabrous except the very pubescent base, the leaves

oblong, more scabrose-setose above and more densely tomentose below. Plants with these distinctions are here included under var. *subcanescens*.

Both forms are said to be distributed in the middle west, Illinois, Wisconsin, Minnesota to Missouri westward, *mollissimus* being also listed for Ohio. Specimens believed to be var. *subcanescens* were collected by the writer in Scott County along Orphans' Home road and Smith's road near Davenport, and in Muscatine County near Wyoming Hill. Others were from the roadside southwest of Kendalville, Winneshiek County, collected by B. Shimek, Sept. 1st, 1926.

HELIANTHUS TOMENTOSUS Michx.

Fl. Am. Bor. 2:141. 1803.

Helianthus spathulatus Ell. Sketch, 2:421. 1824.
Helianthus squarrosus Nutt. Trans. Amer. Phil. Soc. 7:367. 1841.

Stem: 1-2.5 m. tall, simple to the inflorescence, scabrous, hairy-pubescent or hispid above, somewhat glabrous below, variable, the hairs spreading or retrorse, reddish.

Leaves: opposite below, alternate above, variable, oblong-lanceolate, or lowest ovate tapering at both ends, 3-nerved near base of blade, narrowed to base of petiole, rarely with lower portion of petiole distinct, obscurely serrate, 1.5-3 dm. long, 2-8 cm. broad, deep green, scabrous above, densely or thinly soft-pubescent below, hairs spreading to retrorse, resin-dotted.

Heads: several, racemose or panicled on short scabrous peduncles, disks about 2 cm. broad, yellowish.

Involucre: bracts linear-lanceolate, long acuminate, densely hirsute and ciliate, often much longer than the disk, spreading and squarrose, resin dotted, in mature heads very abruptly reflexed.

Ray-flowers: 12-16, about 2.5-3 cm. long, bright yellow, pubescent beneath along the veins, resin-dotted.

Disk-flowers: yellowish, tube short, lobes and base very pubescent.

Chaff: large, 3-cuspidate, middle cusp large, acute, tip and keel very pubescent.

Akene: 5-6 mm. long, brown, thick, somewhat angled, smooth.

Pappus: 2 slender awns, about 3 mm. long.

Underground parts: root perennial, woody, thick; rhizomes few.

This species is extremely variable as to the hirsute nature of

stem and leaves, and the size of the leaves and the extent of the decurrence upon the petiole.

It thrives in rich woods, on hillsides and in dry soil. Its range is throughout the southern states and it is not included in Iowa flora by Gray's Manual, 7th Edition. It is reported from Illinois and Iowa, no doubt, erroneously. (Pammel, 39).

Specimens examined in the herbarium of the Missouri Botanical Garden were collected by John K. Small, in Nacoochee Valley, White County, Georgia, in September, 1894, and by Geo. Engelmann, Cambridge Botanical Gardens, September, 1856. One was a teratological form. A specimen in the Field Museum herbarium was collected by John K. Small, near Chimney Rock, North Carolina, October, 1901.

HELIANTHUS DORONICOIDES Lam.

Encyc. 3:84. 1789.

Helianthus Hookeri G. Don. Lond. Hort. Brit. 358. 1827.
Helianthus pilosus Tausch. Fl. 11:502. 1828.
Helianthus cinereus var. *Sullivanti* T. & G. Fl. N. Am. 3:324. 1842.

Plate XXXVI

Stem: 1-3 m. tall, simple but branched above, smooth below, scabrous-pubescent to hirsute above, hairs spreading, flowering branches ascending.

Leaves: opposite below, alternate above, occasionally all opposite, ovate to ovate-lanceolate, acute or acuminate, 1-3 dm. long, shallowly serrate or upper entire, 3-nerved somewhat below the middle, abruptly narrowed but broadly decurrent to base of petiole, therefore sessile; scabrous-hispid above, softly tomentose below, hairs on midrib and veins long and somewhat spreading-antrorse.

Heads: several, showy, loosely panicled on short leafy hirsute ascending peduncles, disk yellow, 1.5-2 cm. broad.

Involucre: hemispheric, bracts 1.5-1.8 cm. long, attenuate, spreading and reflexed, surface densely hirsute, long spreading-ciliate on margin, base striate.

Ray-flowers: 12-20, bright yellow, 2.5-4 cm. long, 1-1.2 cm. broad, oval.

Disk-flowers: 5 mm. long, yellow, only slightly bulged at base of limb, which is rather densely villous.

Chaff: large, 8 mm. long, 3-cuspidate, apex acuminate, dark in color, hairy at summit and on upper part of keel.

Akene: 5 mm. long, oblong-oval, flattened, not much keeled, glabrous.

Pappus: 2 lanceolate awns with broad chaffy bases.

Underground parts: root perennial; rhizomes short, thick.

This species may be recognized by its general pubescence and spreading antrorse hispidity, the soft tomentose lower leaf-surface, the showy heads on short ascending branches and the spreading to reflexed involucral bracts very hirsute and ciliate. The most notable feature is the large sessile leaf triple-nerved only a little below the middle of the blade, and gradually narrowed to the base of the petiole. No species of sunflower of this region possesses this characteristic. Usually, leaves of Helianthus are 3-nerved, and more or less abruptly narrowed at the base of the blade, and are sessile, distinctly petioled, or narrowed to the base of the petiole.

It resembles *H. tomentosus* Michx, but the peculiar leaves, more hairy involucral bracts, and the absence of resin distinguish it from this near relative. From *H. mollis* Lam., also a close relative, it differs in its peculiar leaf, in being taller with shorter peduncles and in the longer, looser, more hairy involucral bracts.

It is an inhabitant of fields, river bottoms, and dry soil, blooming from August to October. Often grown in cultivation, it is said to be the ancestral form of *H. tuberosus* L.

Its range is from Michigan, Illinois, Ohio, Missouri, Arkansas, throughout the western and inland portions of the southern states.

The specimen examined and here described was loaned by the herbarium of the Field Museum, and was collected by E. Hall near Spring Creek, Sangamon County, Illinois, September, 1860. Other specimens designated as *H. doronicoides* Lam. were from the Missouri Botanical Garden.

The writer has found no plants in the field nor in Iowa herbaria which conformed to the verified specimen examined.

It is reported by J. C. Arthur (2).

Helianthus atrorubens L.

Sp. pl. 906. 1753.

Helianthus sparsifolius Ell. Sketch 2:415. 1848.
Helianthus atrorubens normalis Kuntze Rev. Gen. 1:343. 1891.

Stem: 0.5-1.5 m. tall, slender, branched above, very rough and hairy with long white hairs, smooth to glabrate and naked above.

Leaves: 8-20 cm. or more long, 5-12 cm. broad, mainly on lower part of stem, mostly opposite, upper in small distant pairs, uppermost bract-like, sometimes alternate, ovate, oval, or spatulate-oblong, apex obtuse, 3-nerved, cuneate, truncate, or slightly cordate at base, abruptly contracted and narrowed to the base of the long petiole, often as long as the blade, margin crenate-serrate to nearly entire in upper leaves, veiny, thinnish, but of coarse texture, both sides hirsute or strigose-hispid, hairs on midrib spreading to retrorse.

Heads: 3-7 in open corymbose-panicle, on long slender peduncles bearing a few small bract-like leaves, small but showy, disk dark, about 1.5 cm. broad, receptacle convex.

Involucre: broad campanulate, bracts 9 mm. long, ovate to oblong, shorter than disk, obtuse or mucronate-tipped, unequal, leathery, glabrous or minutely ciliate when immature, appressed, deep green.

Ray-flowers: 10-16, bright yellow, 1.5-2 cm. long.

Disk-flowers: 5 mm. long, lobes dark purple, throat and base yellow, slightly pubescent at base and on veins and lobes.

Chaff: 9 mm. long, entire or barely tricuspid, apex purplish, pubescent, acuminate, exceeding the disk-flowers.

Akene: 3 mm. long, 4-angled, thickish, dark brown, oblong to obovate, entirely pubescent when young, pubescent at summit when mature.

Pappus: 2 thin minutely fringed lanceolate squamellate awns, about 2.5 mm. long.

Underground parts: root perennial, fibrous.

The specimen examined was from a wooded mountain side near Asheville, North Carolina, and was loaned by the Field Museum Herbarium. It was a typical plant of this distinctly marked species, which should never be confused with any other sunflower. Its most striking features are the harsh leaves with their blades narrowed from the abruptly contracted base to the base of the long petiole and the unequal but strictly oblong bracts. Its generally coarse and hairy aspects, the small purple disks, the short bright yellow rays, and the pubescent akenes, combine to make it a very striking and interesting sunflower. As its name implies, "Hairy Wood-Sunflower", its habitat is in and about the open woods. It blooms from August to October.

It is reported in the manuals as ranging south from Virginia to

Florida, Louisiana, Arkansas, west to Missouri, and "said to extend northward to Minnesota" (Gray's Manual, 7 ed.). This distribution, of course, would cover Iowa, but no specimen was found in the field nor in Iowa herbaria. It is not reported by any Iowa author.

Genus Coreopsis L.

Sp. Pl. 907. 1753.

Ascospermum Neck. Elem. 1:34. 1790.
Coreopsides Moench. Meth. 594. 1794.
Anacis Schrank, in Denkschr. Acad. Muench. 5:5. 1817.
Leachia Cass. in Dict. Sc. Nat. 25:388. 1822.
Diodonta Tausch. Hort. Canal. Soc. ser. 2, 7:360. 1823.
Calliopsis Reichb. Ic. et Deser. pl.l.t. 10. 1824.
Campylotheca Cass. Dict. Sc. Nat. 51:476. 1826.
Dolicotheca Cass. Dict. Sc. Nat. 51:476. 1826.
Chrysomelea Tausch. Hort. Canal. 227. 1832.
Electra DC. Prodr. 5:568. 1836.
Agarista DC. Prodr. 5:569. 1836.
Leptosyne DC. Prodr. 5:531. 1836.
Peramibus Rafin. ex. DC. Prodr. 5:568. 1836.
Epilepsis Benth. Pl. Hartw. 17. 1839.
Prestinaria Sch. Bip. ex. Steud. Nom. Ed. 2:393. 1841.
Diadonta Walp. Rep. 2:614. 1843.
Pugiopappus Gray, In Torrey, Botany U. S. War Dept. Expl. R.R. to the Pacific 4:104. 1856.

Coreopsis, from the Greek κόρις meaning "a bug," and ὄψις "appearance", alludes to the insect-like form of the fruit.

The genus is a primitive member of the tribe Heliantheae, and, like *Bidens*, is thought to have been derived, through the genus *Spilanthe*, from the earliest composite form, *Senecio*.[6] Contemporaneously with *Bidens*, *Coreopsis* appeared as early as the upper Pliocene Period of the Tertiary Age in northern South America (regions of Peru, Chile, and Bolivia). Both genera reached their greatest development in Mexico, whence they spread chiefly along mountain ranges to all parts of the temperate and tropical western hemisphere, to Alaska, and to the eastern hemisphere. This wide distribution, and the great number of species developed, together

[6] Small, J. The origin and development of the Compositae. New Phytologist. Repr. 11:309. 1919.

with abundant fossil remains, confirm the accepted view of the early origin of these two closely related genera.

The given number of species in the genus *Coreopsis* varies greatly because of the various interpretations by authors of the awn characters of the akenes. Nuttall (1859) records thirty species extending into the southern hemisphere as far as Peru; Bentham (1873) lists a total of forty species for America with twenty-seven in the United States, ten in Mexico and six in the Andean region; MacMillan (1892) gives seventy to seventy-five species with thirty in North America, seven in Canada, eighteen in the eastern states and twenty in the southern states; Britton and Brown (1913) name fifty species native to the Americas and Australasia. For the territory covered by Gray's Manual, 7th edition, eleven species are included. In Iowa, the two well known species are *C.tripteris* L. and *C.palmata* Nutt. Two others, *C.lanceolata* L. and *C.tinctoria* Nutt. are reported for Iowa, but they are here considered as escapes from gardens.

They are annual or perennial herbs of the drier areas and show interesting adaptations to this environment. Their rigid habit of growth, scabrous surface of stem, and the thick smooth coriaceous leaves are in strong contrast with the generally softer, weaker, more mesophytic or helophytic species of the genus *Bidens*.

Additional features which distinguish the genus are as follows:

Leaves: opposite, of various pinnate forms, or simple with scarious margins.

Heads: small, few to numerous, radiate, the rays neutral, yellow or partly purple-colored, the disk-flowers tubular, 5-lobed, perfect and fertile, anthers entire at base, style-arms truncate, or abruptly cuspidate.

Involucre: a double series of bracts, the outer 8 small, narrow, foliaceous, somewhat spreading, united at base; the inner broad, colored, appressed, almost membranaceous with thin scarious margins, united to about the middle.

Chaff: thin, concave, deciduous with akenes.

Akenes: flat, obcompressed, usually winged, naked at summit, two-toothed, awned, or with a coroniform border.

The important generic distinctions between *Coreopsis* and *Bidens* are found in the involucre and in the margin and awn development of the akene. In Coreopsis the floral distinctions are the smaller, more scarious, somewhat colored inner bracts united toward the

base, the usually winged akene not much narrowed at the summit and practically devoid of any real awn outgrowth. The direction of awn and achenal barbs and hairs is now regarded as too variable and trivial to have generic value. The antrorse feature is no longer held to delimit *Coreopsis* nor the retrorse to delimit *Bidens*.

Key to Species of Genus Coreopsis

a. Stem 1-2.5 m. tall, simple but corymbed at top; leaves petiolate, pinnately 3-5-divided to base, upper undivided ..... *C. tripteris*

a. Stem 3-9 dm. tall, simple; leaves sessile, mostly 3-divided only half way, upper undivided ..... *C. palmata*

COREOPSIS TRIPTERIS L.

Sp. pl. 908. 1753.

Chrysostemma tripteris (L.) Less. Syn. 227. 1832.

Stem: 1-2.5 m. tall, glabrous, strict, rather slender, ternate, simple below, with corymbose flowering branches above, leafy throughout.

Leaves: opposite, petioled, firm, either glabrous or minutely scabrous-puberulent; the radical leaves 5-pinnate, the cauline leaves trifoliate, frequently the middle leaflet again divided; margin very scabrous and with a marginal nerve with which the veins are joined; uppermost leaves simple and entire.

Heads: small, 4-5 cm. broad, numerous on short slender corymbose or fastigiate peduncles, anise-scented when bruised.

Involucre: outer bracts 8, united at base, linear, 2-3 mm. long, narrow, obtuse, short-pubescent; inner bracts 8, ovate, somewhat acute, with yellowish margins, pubescent.

Ray-flowers: 6-10, usually 8, yellow, elliptic-oblong, entire and obtuse, or notched.

Disk-flowers: dull yellow, later brownish, a purple line between the lobes, the 5 lobes erect.

Chaff: linear-spatulate, longer than disk-flowers, obtuse, membranaceous, purple lined, deciduous with akenes.

Akenes: flat, elliptic-oblong to obovate, 5-6 mm. long, brown, narrowly winged, emarginate at summit.

Pappus: a denticulate fringe, fimbriate, nearly confined to the wing, hardly a pappus.

Root: Perennial.

The characters of this species are very pronounced and quite con-

stant. Variations have to do with the extent of branching toward the upper part, the number of heads, and slight modifications of the pinnate leaf-forms. It is rightly called the "Tall Coreopsis" or "Tall Tickseed". Groups of the tall, slender, leafy plants much branched at the top, and bearing numerous small orange-yellow heads make many a bright spot in moist thickets, and along dry borders of streams. It is common on prairies, perferring the lower moist places where it becomes very luxuriant. It blooms through July and August.

In America, this species is widely distributed from Canada to Pennsylvania, Virginia, Carolina and Florida, westward to Missouri, Nebraska, Louisiana and western Texas. In Iowa, it is frequent in low places along roadsides and railroads, on prairies and open woods. Abundant material was found in such places and in the herbaria.

It is reported as common from all parts of the state.

Coreopsis palmata Nutt.

Gen. 2:180. 1818.

Coreopsis pauciflora Lehm. Ind. Sem. Hamb. 1833.
Coreopsis praecox Fresn. Ind. Sem. Hort. France. 1838.

Plate XXXVII

Stem: 5-9 dm. tall, erect, nearly smooth, rigid, simple or some branched, angled, striate, leafy to the top.

Leaves: opposite, sessile, more or less divaricate; pale green, thick and rigid, glabrous or subcoriaceous; 3-cleft to about the middle; the uppermost simple; obtuse with scabrous margins.

Heads: small, 2.5-5 cm. broad, solitary or sometimes several (3-7) on short peduncles.

Involucre: outer 8 bracts 7-9 mm. long, linear, rigid, obtuse, glabrous; inner bracts oblong-ovate, longer than outer bracts, yellowish, nearly membranaceous.

Ray-flowers: 8, oblong-ovate, entire or 3-notched, bright yellow.

Disk-flowers: yellow, the five lobes erect or incurved.

Chaff: linear, acute, slightly dilated at summit, shorter than disk-flowers, deciduous with akenes.

Akenes: obovate or elliptic-oblong, truncate, smooth, narrowly winged, emarginate at summit.

Pappus: really none, or slight extentions of the wings into 2 short obscure teeth, often deciduous.

Root: perennial.

The few and slight variations in this species are confined to the extent of branching and to the number of heads at the top of the plant. The leaves are quite uniformly 3-cleft below, and simple above. Ternate-leaved variants occasionally are found.

Coreopsis palmata Nutt., known as the "Stiff Tickseed", is readily recognized as it stiffly sways among the grasses of the dry prairies and sunny hillsides. It occurs also in open woods and on sand and gravel areas. (Shimek, 52). One of the early composites to come into bloom, it lasts only through June and July, few blossoms appearing in August.

In North America it ranges from Manitoba, Michigan, Minnesota throughout the Minnesota valley, to Nebraska, Arkansas and western Texas. In Iowa, it is common on the prairie throughout the state, growing in small isolated groups or as scattered individuals. Abundant material was secured in field and herbaria.

It is included in all county and state prairie lists.

Genus Bidens L.

Sp. Pl. 831. 1753.

Pluridens Neck. Elem. 1:86. 1790.
Edwarsia Neck. Elem. 1:87. 1790.
Kerneria Moench. Meth. 595. 1794.
Ceratocephalus Vaill. ex. Cass. Dict. Sc. Nat. 7:432. 1817.
Delucia DC. Prodr. 5:633. 1836.

Bidens, from the Latin meaning "having two teeth", refers to the pappus of persistent rigid awns. By the lateral fusing of many setae a few aristae are formed, usually two to four. The barbs of the aristae are merely the slightly projecting free ends of the setae, sharp thornlike structures, which may be erect (antrorse) or reflexed (retrorse).

This awn type of fruit-distributing organ, dominant in the Tribe Heliantheae, appeared later geologically than the capillary type found in *Senecio*, and probably developed from the latter wind-carrier. When the slowly rising Rockies and Andes restricted the wind-swept areas where the capillary type of pappus had long been the successful organ of dispersal, animals of forest and plain became

the efficient dispersers of seeds. The fusion of setae, with free ends extended into barbs, thus resulted in a world-wide distribution of this genus. The great number of species universally distributed, and the abundant fossil remains found in the Upper Pliocene Period of the Tertiary Age further indicate the early origin of *Bidens* (Small 1919).

It is certain that South America (Brazil and Chile) was the original home of *Bidens* and related genera, the regions of greatest development being Mexico and the United States. Their spread throughout temperate and tropical regions of both hemispheres developed new species nonexistent in their first home.

The early distinction made between the two closely related genera, *Coreopsis* and *Bidens*, was based chiefly upon the direction of the akenal hairs and of the barbs of the awns. Species with antrorse awn-character were included in *Coreopsis*, and others with retrorse awn-character were included in *Bidens*. Britton[7] in 1893, noted the variability and the unreliability of this distinction as a generic feature. He says: "This character has been found completely to fail in the case of *Bidens frondosa* L. which has both or neither, and *B. discoidea* T. & G., I have observed with downward barbs."

Abandoning this awn trait, he was able, then, to transfer to *Bidens* the six forms included in *Coreopsis* having antrorse awns but otherwise with strong Bidens characters. These species as they now stand are: *B. bidentoides* (Nutt.) Britton, *B. aristosa* (Michx.) Britton, *B. coronata* (L.) Fischer, *B. trichosperma* (Michx.) Britton, and var. *tenuiloba* (Gray) Britton. *B. involucrata* (Nutt.) Britton, and *B. discoidea* (T. & G.) Britton.

Dr. E. E. Sherff,[8] after world-wide study of *Coreopsis* and *Bidens*, observes that there remains no absolute uniformity in even one distinctive character. He adds that the presence in *Coreopsis* and the absence in *Bidens* of the two lateral wings on mature akenes is the most strikingly constant character and often is the only basis of distinction. He thus clearly summarizes the limits of these two genera: "*Coreopsis* is maintained because of its peculiar habit and the winged akenes of the Linnaean type species. *Bidens* is maintained primarily because of the peculiar habit, the strongly barbed awns, and wingless akenes of several of the Linnaean type species."

This genus is now made up of some ninety recorded species, large-

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7 Britton, N. L. New or noteworthy Phanerogams. VII. Bull. Torr. Bot. Club 20:281. 1893.

8 Sherff, E. E. Studies in Bidens II. Bot. Gaz. 59:301. 1915.

ly of the American tropical and temperate regions but also naturalized in Europe, Asia, and Africa. Of the twenty-two or more species known in the United States, fifteen are included in the area covered by Gray's Manual, 7th edition. In Iowa, ten species are known: *B. cernua* L., *B. connata* Muhl., *B. comosa* (Gray) Wieg., *B. frondosa* L., *B. vulgata* Greene, *B. Beckii* Torr., *B. aristosa* (Michx.) Britton, *B. involucrata* (Nutt.) Britton, *B. trichosperma* (Michx.) Britton, and *B. bipinnata* L. The following three species are also reported for Iowa: *B. discoidea* (T. & G.) Britton, *B. laevis* (L.) BSP. and *B. coronata* (L.) Fisch. It is believed, however, that these reported species do not exist in the state, and that the names have been applied erroneously to plant forms in Iowa somewhat resembling these species.

The species of Bidens are mostly annuals of the weedy type common to moist areas and waste places, and are listed among the obnoxious weed flora. The characters which distinguish the genus from the other genera of the tribe are as follows:

Leaves: opposite and various, simple or 3-5 segmented, petioled or connate.

Heads: small, radiate or discoid.

Receptacle: mostly flat or slightly convex, chaffy.

Involucre: double, outer commonly large, foliaceous, inner small, membranaceous, striate, somewhat colored.

Ray-flowers: 8, yellow, neutral, absent in some.

Disk-flowers: numerous, tubular, mostly 5-lobed, yellowish or bright yellow, stamens and pistil exserted in some, entire or barely sagittate at base, style-arms subulate-tipped.

Chaff: slender, 3-5 striate, membranaceous, subtending the disk-flowers, deciduous with flowers or fruit.

Akenes: flattened parallel to the bracts, or slender, 3-4-sided, margins antrorsely or retrorsely hispid, rarely corky, entire or crenulate.

Pappus: 2-4 awns, or short teeth antrorsely or retrorsely barbed, sometimes absent.

The striking features distinguishing the species within the genus are the leaf-forms, the presence or absence of ray-flowers, the number of corolla-lobes in the disk-flowers, the number and length of the outer involucral bracts, and, chiefly perhaps, the number, length, and barbed condition of the awns of the akenes.

Key to Species of Genus Bidens

a. Leaves simple, mostly undivided; awns retrorsely barbed . . . . b.
  b. Heads radiate, mostly nodding in fruit; leaves sessile or connate . . . . c.
    c. Rays 1½ times as long as disk; akenes wedge-obovate, strongly keeled, with light corky margins. *B. cernua*
    c. Rays larger; akenes cuneate, not strongly keeled, without corky margins. *B. laevis*
  b. Heads discoid, erect; leaves petiolate or connate . . . . d.
    d. Leaves slender petioled, lower often deeply parted; akene narrowly cuneate, 4-angled, 4-awned; disk-flower 5-toothed, orange-yellow. *B. connata*
    d. Leaves connate, all entire; akene flattened, scarcely angled, mostly 3-awned; disk-flower 4-toothed, pale yellow. *B. comosa*
a. Leaves mostly pinnate or finely dissected; awns antrorsely or retrorsely barbed . . . . e.
  e. Leaves mostly immersed, finely dissected; heads conspicuously radiate. *B. Beckii*
  e. Leaves aerial, pinnate; heads discoid, or radiate . . . . f.
    f. Leaves ternately compound; outer bracts 4, much exceeding disk; akenes and awns antrorsely barbed. *B. discoidea*
    f. Leaves pinnate with 3-7 leaflets; outer bracts several, equalling or exceeding disks; awns retrorsely barbed . . . . g.
      g. Akenes oblong spindle-shape, antrorsely barbed, 3-4 awned; leaves often 2-3 pinnatifid. *B. bipinnata*
      g. Akenes flattened, antrorsely or retrorsely barbed, 2-awned; leaves 1-pinnate. . . . h.
        h. Heads discoid, or rays few and small, outer bracts exceeding disk; awns mostly retrorsely barbed, rarely antrorse . . . .i.
          i. Outer bracts ciliate; akenes cuneate, black, slightly hairy. *B. frondosa*
          i. Outer bracts hispid-ciliate, akenes oblong-cuneate to obovate; brown, smooth or tuberculate. *B. vulgata*
        h. Heads radiate, rays conspicuous; outer bracts not exceeding disk; awns, if present, antrorsely barbed or hispid . . . . j.
          j. Akenes narrowly wedge-oblong, not margined; awns awl-shaped. *B. trichosperma*
          j. Akenes elliptic-obovate with thin scarious margins; awns long or reduced to short teeth, or absent . . . . k.
            k. Outer bracts longer than inner, coarsely hispid, akenes strigose-hispid, especially on margins. *B. involucrata*
            k. Outer bracts shorter than inner, smooth or ciliate; akenes slightly hispid or pubescent . . . . l.
              l. Margins of akenes crenate, awns long and slender, or reduced to short teeth or wanting; leaves all pinnate. *B. aristosa*

1. Margins of akenes not crenate, but very narrowly winged; awns 2 short blunt teeth; leaves sometimes simple or only slightly divided. *B. coronata*

Bidens cernua L.

Sp. pl. 832. 1753.

Coreopsis bidens L. l. c. 908. 1753.
Bidens minima L. l. c. 908. 1753.
Bidens cernua var. *elata* T. & G. Fl. 2:352. 1841.
Bidens quadriaristata var. *dentata* Nutt, Trans. Amer. Phil. Soc. 7:368. 1841.
Bidens gracilis Greene, Pittonia 4:255. 1901.

Stem: 3-6 dm. tall, erect to somewhat procumbent, branches short, decreasing in length toward the base, pale green, smooth, or setulose-hispid toward the top.

Leaves: opposite, simple, smooth and glabrous, linear-lanceolate, acuminate, the upper narrowed into a connate or subconnate base, the lower merely opposite and sessile, margin with coarse unequal distant teeth.

Heads: wider than high, mostly solitary, nodding in maturity or small and young heads erect, discoid or radiate.

Involucre: bracts 6-7, unequal, longer than the head, usually foliaceous, often three or four times as long as the disk, erect and very conspicuous, inner bracts with membranous margins, not purple-tipped.

Ray-flowers: 8 yellow, sometimes absent.

Disk-flowers: narrowed about the middle, 5-lobed, orange-yellow, smooth.

Chaff: slender, orange-yellow tipped, deciduous with akenes.

Akenes: dark brown or greenish, often curved, obovate to cuneate or wedge-shaped rhomboidal, somewhat dilated at the summit, strongly 4-angled, tuberculate on angles, the light corky margins retrorsely ciliate-hispid.

Pappus: 4 (sometimes 2 or 3) slender erect awns retrorsely barbed.

It seems that no plant could be more variable in all its parts. In a single patch will be found small procumbent forms bearing one or two large radiate or discoid nodding heads, or small erect heads with involucral bracts not much exceeding the disk; there will be found large erect forms with long foliaceous involucral bracts and many other intermediate forms not much resembling these two ex-

treme vegetative phases of the species. For this reason, much confusion has existed and many new species names have been proposed, later to be reduced to synonomy or applied to varieties. The large forms with erect radiate heads resemble *B. laevis* (L.) BSP. and often are reported as such, but this latter species is not included in the region covered by Gray's Manual, 7th edition, nor in Iowa.

This "Nodding Bur Marigold" is said to have been introduced from Europe. Its range in North America is from Nova Scotia and New Brunswick to Hudson Bay, and from Saskatchewan to Montana and Oregon, south to Virginia, Missouri, and Colorado. In Iowa, it is one of the most common and abundant species of the marshes, swamps, and other wet places, as shores of rivers and ponds. It is rather common in peat and sedge bogs though more abundant where these areas have been drained. (Pammel, 34).

Abundant material was secured from all swamp areas visited by the writer and the state herbaria abound in specimens in all vegetative and floral phases.

It is reported as an abundant and wide-spread swamp species in all parts of the state.

Bidens connata Muhl.

Willd. Sp. pl. 3:1718. 1804.

Bidens tripartita Bigl. Fl. Bost. 2nd ed. 2:294. 1824.
Bidens petiolata Nutt. Journ. Acad. Phil. 7:99. 1834.

Plate XXXVIII

Stem: 0.5-1.5 m. tall, moderately and loosely branching, with rather long internodes, glabrous, striate, bright green, or upper stem and branches purplish.

Leaves: opposite, bright green, mostly simple, lanceolate to elliptical, acuminate, tapering to the slender and slightly connate petioles, the lower leaves sometimes deeply 3-parted with the lateral segments connate at base and narrowed on the petiole.

Heads: medium, usually discoid, 1.5 cm. broad, several to numerous on short peduncles.

Involucre: outer bracts 4 or 5, linear-spatulate to lanceolate, mostly obtuse, much exceeding the disk, glabrous or scarcely at all ciliate, inner bracts about 8, ovate and obtuse, often keeled, 7-8 mm. long, brownish.

Ray-flowers: wanting or rarely present, inconspicuous, golden yellow.

Disk-flowers: 5-lobed, deep orange-color, narrowed below the middle, stamens and pistil often exserted.

Chaff: slender, slightly longer than the disk-flower, or a little shorter.

Akenes: 4-5 mm. long, dark green or nearly black, cuneate, outer akenes obovate and thick, 4-angled, often keeled, glabrous or slightly hairy and with brownish or light colored warts, margins retrorsely hispid or some marginal barbs antrorse toward base, young akenes hairy, often awnless.

Pappus: of 2, 3, or 4 slender awns ¼-½ the length of the akene, retrorsely or occasionally antrorsely barbed, inner akenes with hispid-ciliate awns, or none.

Root: annual, fibrous.

Bidens connata Muhl., called the "Purple-Stemmed Swamp Beggar's Ticks", is extremely variable in all its parts, but chiefly so in the leaf form and length of petiole, and in the awn characters of the akenes. Fernarld,[9] in his review of this species says that it commonly occurs with simple leaves (var. *petiolata* (Nutt.) Farwell), but occasionally it possesses tripartite leaves matching Muhlenberg's original description. Sherff[10] writes of observing with Fernald abundant tripartite-leaved forms of this species, from Cambridge to Winchester, Massachusetts. These were young vigorous plants, 3 dm. high. He also says that in the central United States, tripartite leaves appear only on robust well-developed plants. He extends Fernald's given range, Quebec, Massachusetts, and Michigan southward, to Elgin, Illinois.

Fassett[11] describes six varieties of this species as found in Wisconsin, based mostly on the leaf forms, length of outer involucral bracts, size of akenes and especially on the direction of akenal hairs and awn barbs. Space does not permit discussion of these findings with reference to Iowa, but the form most commonly found and herein described has the simple narrowly margined or distinctly petioled leaves, frequently with lower leaves tripartite in large vigorous plants.

Fassett delimits the varieties of *B. connata* as follows:

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9 Fernald, M. L. *Bidens connata* and Some of its allies. Rhodora 10:197. 1908.

10 Sherff, E. E. Studies in Bidens IV. Bot. Gaz. 64:21. 1917.

11 Fassett, Norman C. *Bidens connata* and its varieties in Wisconsin. Rhodora 30.31-37. 1928.

1. var. *typica*: leaves simple or cleft; winged petioles; outer bracts 1.5 cm. long; akenes not more than 6.5 mm. long, retrorsely barbed except near base.
2. var. *fallax*: an offshoot of var. *typica*; leaves simple, often 3-cleft, petioles winged; outer bracts 3-6 cm. long; akenes as in var. *typica*.
3. var. *petiolata*: middle leaves simple, rarely 2-3-cleft; petioles 7 cm. long, very narrowly margined; inner akenes 7-8 mm. long, retrorsely barbed except sometimes near base.
4. var. *ambiversa*: leaves simple, coarsely dentate to 3-cleft; outer bracts 1-3.5 cm. long, foliaceous; outer akenes 5 mm. long, inner akenes 6-8 mm. long, margins with sparse to copious, mostly antrorse hairs, awns with antrorse or retrorse barbs or intermixed.
5. var. *anomala*: leaves simple, rarely with 2 basal lobes; outer bracts 1-3.5 cm. long, foliaceous; akenes as in var. *ambiversa*, margins and awns antrorsely barbed.
6. var. *pinnata*: lower and middle leaves 3-7-pinnately divided, base of each division narrowed upon the petiole; outer bracts mostly 1-1.5 cm., foliaceous; outer akenes 4.5-5 mm. long, 3-awned, inner akenes 6-7 mm. long, retrorsely barbed.

It grows in swamps and ditches and in low woods, frequently being found associated with *B. cernua*, and *B. comosa*.

Its range in the United States is from New Hampshire, Massachusetts, and Virginia westward to Minnesota and Missouri, being very common in all Mississippi Valley states. In Iowa, it is common to scarce, generally distributed over the state, chiefly in swamps and low moist ground. The writer secured vigorous plants in such moist areas in Muscatine, Scott, and Johnson Counties, these often with the lower leaves tripartite. (Pl. XXII).

It is reported by counties as follows: Cerro Gordo (34), Decatur (14), Emmett (34), Fayette (12, 15), Hamilton (34), Hardin (40), Henry (12), Iowa (57), Johnson (14, 56), Mitchell (59), Story (12, 20), Webster (27), Winnebago (34), Winneshiek (11), and from the state of Iowa (17).

BIDENS COMOSA (Gray) Wiegand.
Bull. Torr. Club 24:436. 1897.

Bidens connata var. *comosa* A. Gray, Man. 5 ed.:261. 1867.
Bidens riparia Greene, Pittonia 4:61. 1901.
Bidens acuta Wiegand, Britton, Man. 1001. 1901.

Plate XXXIX

Stem: 2-10 dm. tall or more, straight, stout, stramineous throughout, touched with purple, branches short and stout, ascending.

Leaves: opposite, simple, lanceolate or elongate elliptic, obtuse or acute, attenuate to a long margined petiole or the upper sessile, connected at base, coarsely serrate, teeth ascending, pale dull green, glabrous except on margins, veins straight and ascending, ending in the teeth or sinuses.

Heads: large 12-15 mm. high, 15 mm. broad, discoid, arranged cymosely on short stout peduncles in upper axils, appearing clustered.

Involucre: outer bracts 6-8, large, erect, spatulate, obtuse, often foliaceous and toothed.

Ray-flowers: wanting.

Disk-flowers: about 4 mm. long, pale greenish or lemon yellow, 4-lobed (occasionally 5-lobed), narrow funnel-form with stamens and style included.

Chaff: slender, acute, yellow-tipped, brown striate, shorter than disk-flower, deciduous with akenes.

Akenes: 7-10 mm. long, 3 mm. broad, cuneate, summit not convex, slightly or scarcely keeled, olive or brown, often minutely dark-dotted, striate, margin not crenulate, mostly retrorsely hispid except toward base.

Pappus: usually 3 straight stout awns ⅓-¾ as long as akene, equalling or longer than disk-flowers, retrorsely barbed.

Root: annual.

B. comosa is a very characteristic species as it stands in large crowded patches. Its stout straw-colored stem, and short sturdy branches identify it at once. The akene, mostly 3-awned, retrorsely barbed, is unique among American representatives of the genus. The pale leaves, foliaceous involucre of numerous bracts, and the pale yellow 4-lobed disk-flowers are other features that distinguish it from *B. connata*, with which it is frequently confused. The variety *acuta* has the outer bracts acute and not much longer than the inner ones; the akenes of the specimens examined were narrow wedge shaped and had three awns.

This species was not recognized as such by early botanists but was thought to be a variant of *B. connata* Muhl. Gray[12] noted constant

[12] Gray, A. A Manual of Botany of Northern United States. Edition 5, 1867.

differences among certain *Bidens* hitherto called *B. connata* Muhl., and separated the variety *comosa* as being a stouter, paler form with leaves commonly all simple, the upper sessile, and with heads larger and with very leafy involucre. In 1897, Wiegand[13] reaffirmed these characters as distinct and constant, and he also observed several features unnoted before. "Convinced that under *B. connata* there were two distinct forms", he erected the new species *B. comosa*. Describing both species and listing their differences, he thus definitely placed *B. comosa* on record as a species.

The habitat of *B. comosa* is always in low moist ground, and in swamps, sandy soils and mud flats along streams; it is frequently found with *B. connata*.

Its distribution in the United States is from Maine to Minnesota, Illinois, and Kentucky, west and southwest. In Iowa it is perhaps as common as *B. connata*. The writer secured plants from swamps and low places in Scott and Muscatine Counties. Herbarium specimens were from the counties of Dallas, Union, Fayette, Clayton, Hardin, Chickasaw, Polk, Floyd, Story, Van Buren, Henry, Appanoose, Decatur, Boone, Marshall and Cedar.

It is reported as common in wet soil in counties as follows: Decatur (12), Fayette (10, 12, 15), Johnson (12, 56), Muscatine (4), Scott (4), Webster (27) and from the state of Iowa (7).

Bidens frondosa L.

Sp. pl. 832. 1753.

Bidens melanocarpa Wieg. Bull. Torr. Club. 26:405. 1899.

Plate XL

Stem: 5-10 dm. tall, slender, bushy-branched, glabrous or slightly hairy, furrowed, reddish in the upper parts.

Leaves: opposite, lower pinnately 5-divided, upper 3-divided, often all 3-divided, divisions distinct and mostly petiolate, lanceolate or the terminal one ovate-lanceolate, acuminate, serrate, with spreading teeth, green both sides, petioles and under surface slightly hairy, thin but not membranous, veins prominent, straight.

Heads: numerous, discoid or rays rudimentary, rather small on long, slender, reddish, axillary branches.

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13 Wiegand, Karl M. A new species of Bidens. Bull. Torr. Bot. Club 24:436-437. 1897.

Involucre: outer bracts 5-8 or more, unequal, spatulate, acute, ciliate toward base, conspicuous and much exceeding the disk, inner bracts brownish, ovate, as long as disk, ciliate toward base, innermost bracts membranaceous with transparent margins.

Ray-flowers: usually none on later heads, small and inconspicuous when found on earlier heads.

Disk-flowers: usually 5-lobed, orange-yellow, funnel-form, narrowed about the middle, stamens exserted.

Chaff: slender, falling with akenes.

Akene: brown, 7-8 mm. long, 4-5 mm. broad, very flat, rugose, contracted at the top, nearly glabrous, one nerved, margins mostly antrorsely hispid except near the top—a somewhat variable character.

Pappus: 2 firm erect diverging awns mostly retrorsely barbed occasionally antrorse, usually more than ½ as long as the akene, longer than disk-flower.

Root: annual, fibrous.

Bidens frondosa L. is a very distinct species, recognized by its 3-5-parted leaves, reddish stems, discoid heads and very conspicuous outer involueral bracts. The trifoliate forms of this species are often called *B. discoidea* (T. & G.) Britton, but the 6-8 large foliaceous bracts (not 4 as in *B. discoidea*), the shorter petioles of the leaflets, the less membranaceous leaves, and the retrorsely barbed awns distinguish it from the latter species. In the herbarium of the State University of Iowa is a delicate immature plant with trifoliate leaves, akenes and awns antrorsely hispid which has been designated as *B. frondosa* L. var. *anomala* Porter. Fernald regards this form as a geographic variety. (Pl. XL).

This species is one of the most common wet-area plants throughout the United States from Ontario to North Carolina westward to Texas and California; it is not reported for New England. In Iowa, it is abundant and conspicuous and is included in the list of troublesome and noxious weeds.

BIDENS VULGATA Greene.

Pittonia 4:72. 1899.

Bidens frondosa var. *puberula* Wieg. Bull. Torr. Club. 26:408. 1899.

Plate XLI

Stem: 0.5-1.5 m. tall, much branched, nearly glabrous.

Leaves: 5-divided, quite uniform except the very uppermost, seg-

ments lanceolate, short stalked, veins straight as in *B. frondosa*, margin serrate with regular sharp or bluntish teeth, nearly glabrous.

Heads: large, 1.5-2.5 cm. broad, on stout peduncles, discoid, rarely radiate.

Involucre: outer bracts 10-15, unequal, usually longer than the disk, ciliate-hispid, inner bracts with abruptly narrowed tips, membranaceous margins, ciliate on tips and along the veins, shorter than disk.

Ray-flowers: rarely present, pale yellow, equalling disk.

Disk-flowers: 5-lobed (occasionally 4-lobed), pale yellow, narrowed about half way, stamens included.

Chaff: slender, about the length of disk flower, acute, deciduous with akenes.

Akenes: large, 7.5-12 mm. long, 4-4.5 mm. wide, brown, obovate or cuneate, very flat, smooth, or often tubereulate-roughened, margins upwardly hispid except near summit.

Pappus: 2 large retrorsely barbed awns, exceeding the disk-flower, half as long as akene, stramineous.

Root: annual, fibrous.

The variety *puberula* Wieg. differs from the species in that the peduncles, leaves, and outer bracts are covered with soft whitish hairs giving a somewhat hoary or grayish appearance, the inner bracts also are pubescent, the leaves are more finely and bluntly serrate.

This species was formerly included with *B. frondosa* L. which it resembles in general appearance. But the akenes are larger, with margins upwardly hispid, the involucre is less conspicuous and is ciliate, the leaves are more uniformly 5-pinnate, with segments short-petioled and margins finely and evenly serrate.

It was first made a variety by Wiegand[14] who in 1899 named it *Bidens frondosa* var. *puberula*. In the same year Greene raised this variety to the rank of a species under the name *B. vulgata*. The var. *puberula* Wieg. is retained in Gray's Manual, 7th edition, used with the species.

Both forms grow abundantly in moist waste places along roadsides, near swamps and lakes, often with *B. frondosa*. In the United States they are distributed from Ontario to Pennsylvania

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[14] Wiegand, Karl M. Some species of Bidens. Bull. Torr. Bot. Club 26:399-431. 1899.

and North Carolina westward to Wisconsin, Missouri, and to British Columbia and California, not so common as *B. frondosa*. In Iowa the species is nearly as common as *B. frondosa* and perhaps is frequently called by that name.

Specimens of both the species and the variety were secured by the writer from all territory visited. Near the Inn on Lake West Okoboji, was found an immature but vigorous plant very much resembling the grayish var. *puberula*. The leaves, however, were bipinnately divided and variously lobed. As the writer had no opportunity to return in the later flowering and fruiting season, the status of this plant remains undetermined. Herbarium specimens were from Lee, Muscatine, and Cerro Gordo Counties.

It is reported from the following counties: Dickinson (51), Dubuque (38), Harrison (48), Johnson (56), Mitchell (59), Monona (48) and from the state of Iowa (17, 47, 52).

Bidens bipinnata L.

Sp. pl. 832. 1753.

Bidens Wallichii DC. Prod. 5:598. 1836.

Plate XLII

Stem: 3-15 dm. tall, erect and branching, glabrous, sulcate, striate, obtusely 4-angled, rather slender, greenish.

Leaves: opposite, thin, 1-3 pinnately parted, most often doubly pinnatifid, the segments somewhat lanceolate or ovate wedge-shaped at base, round-lobed and cleft, the basal leaf segments deltoid, the ultimate one lanceolate, incised or lobed, veins prominent and dark, slightly pubescent along margins, petioles long.

Heads: small, on naked slender peduncles, irregularly radiate.

Involucre: outer bracts usually 8, linear-lanceolate, acute, unequal, as long as the rays, at first erect, later spreading, with narrow transparent margins; inner bracts 8, narrower with wide transparent margins, a little longer than outer bracts, hardly as long as the disk.

Ray-flowers: generally 3 or 4, pale yellow, with 4 deep orange colored veins, 2-notched, ovaries awnless.

Disk-flowers: about 20, yellow with prominent orange colored veins, 5-lobed, stamens included.

Chaff: slender, deciduous with akenes.

Akenes: 2 cm. long, including awns, oblong-spindle shape, slightly angled or 4-grooved, nearly twice as long as the awns, antrorsely barbed.

Pappus: 3-4 awns, about ⅔ as long as disk-flowers, stramineous, outer slightly shorter, retrorsely barbed.

Root: annual.

The outstanding features of this rare species are the greenish stem, the 1-3-pinnatifid leaves with rounded lobes, and especially the long slender almost needle-like akenes. One would never confuse it with other species of *Bidens* and in its vegetative phases, it might even escape recognition as a *Bidens*. It flowers and fruits in late summer and through the fall.

Its given distribution is Rhode Island to Florida, westward to Ohio, Nebraska, Arizona, Mexico and tropical America. From New York it is reported as found in various situations, often as a weed, and from Missouri as common in low ground and waste places. Elliott[15] reports it from Carolina as common in dry soil.

In Iowa at least one specimen is known to exist. This plant was collected by Dr. Jesse L. Fults in Lee County, Sept. 4th, 1931 and is in the herbarium of the Iowa State College at Ames. It was loaned to the writer by R. I. Cratty. Only the uppermost parts are preserved. An immature plant found growing near Manhattan on Lake West Okoboji and thought to be *Bidens bipinnata*, was later designated as *B. vulgata* var. *puberula* Wieg. with bipinnate leaves.

Two authors report it from Iowa: H. A. Mueller from Madison County (25), and L. H. Pammel (36).

Bidens Beckii Torr.

Spreng. Neue. Entdeck. 2:135. 1821.

Megalodonta Beckii (Torr.) Greene, Pittonia. 4:271. 1901.
Megalodonta nudata Greene, loc. cit. 1901.

Plate XLIII

Stem: aquatic, submerged and attached to the bottom of pond or lake, usually rising a little above the surface at flowering season, simple or rarely branched, glabrous, slender, flexible, held up by the buoyancy of the water, collapsing when withdrawn.

Leaves: opposite, mostly submerged, dichotomously dissected, sessile, crowded, the few emerged leaves lanceolate, slightly connate, serrate or incised.

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15 Elliott, S. A Sketch of the Botany of South Carolina and Georgia II: 432. 1824.

Heads: solitary, on short terminal peduncles, rising a few inches above the water, occasionally remaining submerged, radiate.

Involucre: bracts yellowish with brown stripes, the 5 outer bracts shorter than the inner.

Ray-flowers: 6-10, golden yellow, oblong.

Disk-flowers: very delicate, hyaline, 5 lobes somewhat spreading, anthers pale, style-branches ending in conical, acute, densely hairy appendages.

Chaff: broader than in other species, deciduous with flowers.

Akene: (Only immature ones secured), narrow-oblong, thick, slightly flattened or nearly terete, truncate at base and summit, entirely glabrous.

Pappus: usually 4 unequal divergent awns, retrorsely hispid all the way when young, barbed only at tips in maturity.

Root: perennial.

This unusual species of *Bidens* was named after Dr. Lewis E. Beck who discovered it in a pond near Schenectady, New York. Dr. E. E. Sherff prefers to maintain the genus name *Megalodonta* Greene, claiming that the very large thick fruit is really not a Bidens feature.

It is the only true hydrophyte of the genus, as well as of the Tribe Heliantheae in North America. The slender, weak stem buoyed up by the water, and the crowded, finely dissected submersed leaves are interesting adaptations to its water environment; both the stem and the aquatic leaves have large air-spaces and very thin epidermis devoid of stomata. In these respects, the species resembles other lake plants such as *Myriophyllum*, *Ceratophyllum*, and *Ranunculus*. The emerged leaves are entire and possess stomata. Sometimes specimens are found entirely submerged, no air leaves being present, the mature inflorescence also entirely covered by the water, and not emerged a few inches as is usually the case. Completely submerged plants with all leaves entire (not dissected) occasionally are found.

What becomes of the mature akenes is not known, nor how distribution from one pond to another is brought about. The supposition, however, is that the fruits may be carried by water birds.

The species is now known to be distributed in American ponds and slow-moving streams from Quebec to New Jersey, Massachusetts and Vermont, westward to Manitoba, Illinois, and Iowa.

Specimens in full flower were secured by the writer in August

and September, from Lake West Okoboji in Dickinson County. The plants shown in Plate XLIII were sent by Dr. G. W. Martin from this same locality near the Iowa Lakeside Laboratory. Other specimens in the herbaria are from Cerro Gordo and other Dickinson County lakes.

It is reported as locally abundant in lakes and ponds in the following counties: Cerro Gordo (34), Dickinson (51, 61), Hamilton (34), Story (12, 20), Wright (34) and from the state of Iowa (1).

Bidens aristosa (Michx.) Britton.

Bull. Torrey Club 20:281. 1893.

Coreopsis aristosa Michx. Fl. Bor. Am. 2:140. 1803.
Coreopsis aristata Muhl. Willd. Sp. Pl. 3:2253. 1804.

Plate XLIV

Stem: 0.3-1 m. tall, much branched, quadrangular, smooth below, pubescent above, sometimes sparingly so.

Leaves: opposite, petioled, 5-7-divided with segments acuminate at both ends, serrate, incised or pinnatifid, veins and midrib reddish, thin and soft, under surface pubescent.

Heads: numerous, small, 2-5 cm. broad, paniculate-corymbose, peduncles long and slender, disk yellow.

Involucre: hemispheric, outer bracts 8-12, spreading, linear-spatulate to oblong, sometimes slightly ciliate or minutely hispid, usually not exceeding the inner bracts, though sometimes longer and foliaceous, inner bracts broader, barely united at the base or distinct, not resin dotted.

Ray-flowers: 6-10, large, golden yellow, entire.

Disk-flowers: yellow, anthers brown, style-branches cuspidate, stamens exserted.

Chaff: slender, longer than disk-flowers, deciduous with akenes.

Akenes: olive-brown, broad-obovate or oblanceolate, flattened parallel with the scales of the involucre, slightly angled, abruptly contracted at summit, sparingly antrorse strigose or hispid-ciliate and scarious, margins thin, crenate or crenulate and antrorsely hispid, often tuberculate.

Pappus: 2 slender awns nearly as long as akene, diverging, stramineous, upwardly, sometimes downwardly barbed, sometimes short or entirely absent, extremely variable.

Root: annual, fibrous.

Variations in this species center about the akene and its awn characters. At least three types of awns are so common as to give rise to the var. *Fritcheri* Fernald having the long awns retrorsely barbed, and var. *mutica* (Gray) Gattinger with awns entirely absent Pl. XLIV.[16] The outer involucral bracts also show variation, being not at all dependably shorter than the inner bracts. Plants from which the drawings and plates were made had outer bracts variously shorter, as long as, or longer than the inner ones. Specimen No. 783171, Missouri Botanical Garden, collected by John Davis near Oakwood, Missouri, has very long foliaceous bracts with smooth surface and margins; the akenes of this plant have scarious erenulate margins and short thick spreading awns.

Perhaps the most reliable floral feature of *B. aristosa* is the scarious margin, antrorsely erenulate and hispid; but even this was found to fail in Specimen No. 777409, Missouri Botanical Garden, and also in a specimen from the herbarium of the Field Columbian Museum, both verified by E. E. Sherff. These have the akene margin merely antrorsely hispid, not scarious nor erenulate, in this respect resembling more the akene of *B. involucrata* (Nutt.) Britton.

Because of the upwardly hispid margins, the species was originally included in the genus *Coreopsis* as *C. aristosa* Michx., but Britton (1893) transferred it to the genus *Bidens* on account of the true awns in some forms.

It thrives in moist soil, swamp, peat bogs and low wet woods, and is perhaps the most delicately beautiful of the Bidens.

It is distributed from Ohio to Michigan, Iowa, Kansas and Texas, very abundant in Missouri and probably native in southern Iowa. The writer secured specimens along the canal near Lake West Okoboji, Dickinson County, and along Duck Creek near Davenport. Herbarium specimens were from Madison, Allamakee, Iowa, and Muscatine Counties. Specimens for verification were from the Missouri Botanical Garden and Field Columbian Museum, verified by E. E. Sherff.

It is reported among the weed flora from the following counties: Benton (12), Muscatine (4, 12), Scott (4), Wapello (36), Marion (36), Polk (36), Decatur (36) and from the state of Iowa (17).

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16 Fernald, M. L. Some noteworthy varieties of Bidens. Rhodora 15:74-80. 1913.

BIDENS INVOLUCRATA (Nutt.) Britton
Bull. Torr. Club 20:281. 1893.

Coreopsis involucrata Nutt. Journ. Phil. Acad. 7:74. 1834.

Plate XLVI

Stem: 3-10 dm. tall, slender, simple but usually with short lateral branches, quadrangular below, minutely pubescent.

Leaves: opposite, 5-7-pinnately divided, divisions narrow, linear-lanceolate, long acuminate, serrate and incisely toothed.

Heads: several to numerous, somewhat paniculate on slender hirsute peduncles, radiate, 3-5 cm. broad.

Involucre: outer bracts 12-20, linear, acutish, hispid on back and margins, longer than inner bracts which are brown with yellowish tips.

Ray-flowers: usually 8, golden yellow, 2 cm. long.

Disk-flowers: 5-lobed, light yellow, tubular, narrowed abruptly below the middle into a slender tube, stamens exserted.

Chaff: slender, longer than disk-flowers, somewhat acute, deciduous with fruit.

Akene: elliptic obovate to oval, very flat, slightly contracted at the summit, upwardly strigose-ciliate especially on thin scarious margins.

Pappus: 2 very short teeth upwardly barbed or hispid.

Root: annual, fibrous.

B. involucrata, the "Long-bracted Tickseed Sunflower", resembles in appearance both *B. trichosperma* and *B. aristosa*, but is distinguished from them by the larger heads, the more numerous and hispid outer involucral bracts exceeding the disk, the inner bracts yellow-tipped, and upwardly hispid akenes; the segments of the leaves are narrower and more acuminate. The variety *retrorsa* Sherff, examined at the Missouri Botanical Garden, has awns retrorsely barbed and the margin of the akene antrorsely hispid.

It grows abundantly in low grounds and marsh-meadows, coming into bloom in July and lasting through the summer and fall.

It is indigenous to the Mississippi Valley, ranging from Illinois to Kansas, Arkansas and Texas, rarely adventive eastward. In Iowa it is common in the southern and southeastern parts and frequent in northern swampy areas.

R. I. Cratty[17] writes of this species: "This pretty composite is very common in the southern part of the state occurring in large patches in low ground, and is gradually working northward. It is confused with two similar species, *B. trichosperma* and *B. aristosa*, which are comparatively rare in the northeastern section. The mature akene and the bracts furnish the most reliable characters in distinguishing these three species." Thrifty plants of this species were gathered by the writer from low moist places along roadsides and in swamps in Muscatine County. Herbarium specimens were from the following counties: Appanoose, Union, Woodbury, Muscatine, Fremont, Van Buren, Marion, Lucas, Page, Madison, Decatur, Polk, Chickasaw, Story, Wapello, Boone, Marshall, Emmett and Jasper.

It is reported for Iowa as follows: Decatur (12), Johnson (56), Scott (4), Webster (27) and from the state of Iowa (17).

Bidens trichosperma (Michx.) Britton.

Bull. Torr. Club 20:281. 1893.

Bidens trichosperma var. *tenuiloba* Britton Bull. Torr. Club 20:281. 1893.
Coreopsis trichosperma Michx. Fl. Bor. Am. 2:139. 1803.
Coreopsis aurea Lindl. Bot. Reg. 1228. 1829.
Coreopsis trichosperma var. *tenuiloba* A. Gray, Syn. Fl. 12:295. 1884.
Diodonta coronata Nutt. Trans. Am. Phil. Soc. 7:360. 1841.

Plate XLVII

Stem: 6-15 dm. tall, slender, obscurely quadrangular, glabrous, much branched toward the top.

Leaves: opposite, somewhat pinnately divided into 4-8 distant segments, narrowly lanceolate, acute or acuminate, segments remotely cut-serrate or incised, the upper often merely 3-cleft and nearly sessile, thin.

Heads: 4-5 cm. broad, sometimes more, erect, long-peduncled, paniculately corymbose, radiate.

Involucre: outer bracts 8, linear-spatulate, obtuse, entire, rarely ciliate, fringed with small setaceous teeth equalling or shorter than the disk and about the length of the inner ones; inner 8 bracts entire, striate, colored.

Ray-flowers: several, usually 8, bright yellow, 1.2-2.5 cm. long, entire or bidentulate at apex.

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17 Cratty, R. I. Iowa Plant Notes IV. Ia. Acad. Sci. 37:89. 1930.

Disk-flowers: 5-lobed, bright yellow, stamens brownish, exserted.
Chaff: about as long or slightly longer than disk-flower, slender, acute, deciduous with akenes.
Akenes: 5-7 mm. long, narrowly cuneate to oblong wedge-form with prominent ridges, narrowed at summit, minutely or sparsely hairy, upwardly strigose-ciliate above.
Pappus: 2 subulate hispid teeth sometimes developed into short stout erect awns upwardly barbed, quite variable and occasionally obsolete, short intermediate teeth sometimes extend from the ridges, all teeth then being connected. The var. *tenuiloba* Gray has smaller akenes with spreading teeth.
Root: annual.

Because of the prominent ridges of the wedge-shape akenes, the variable awn structures, and the upward hispidity, *B. trichosperma* was formerly placed in the genus *Coreopsis*. In 1893, Britton transferred it to the genus *Bidens* on the ground that it possessed real awns. Even so, the fact of the prominent ridges and the frequently obsolete teeth or awns makes identification a difficult process. To the casual observer *B. trichosperma*, *B. aristosa*, *B. involucrata* and *B. coronata* resemble one another, and only by patient persistent examination in field and herbarium and with the lens can the reliable distinctions be brought out.

Herbarium specimens from the Missouri Botanical Garden and from the Field Museum, verified by Dr. E. E. Sherff were used for comparison in this study. Also specimens from the herbarium of the University of Wisconsin were loaned by Dr. N. C. Fassett.

Like the other "Tickseed Sunflowers", *B. trichosperma* grows in swamps, peat bogs and other wet places. It comes into bloom in June, continuing through the summer and fall until frost.

Its range is from New York, southward to Virginia, North Carolina, Georgia, westward to Minnesota, Illinois, Kentucky and Nebraska. In Iowa, it occurs in all peat bogs of many of the northern counties. "It is so characteristic that without the presence of any other plants, one is certain peat occurs." (Pammel, 34). Specimens of this species are to be found near Wilton, and also at the edge of the woods at Wild Cat Den. Herbarium specimens were from Cerro Gordo, Van Buren, Lee and Hancock Counties.

It is reported from the following counties: Cerro Gordo (34), Hardin (40), Mitchell (59), Scott (4), Webster (27), Winnebago (34) and from the state of Iowa (17).

BIDENS LAEVIS ((L.) BSP.
Prel. Cat. N. Y. 29. 1888.

Helianthus laevis L. Sp. Pl. 906. 1753.
Coreopsis bidens Walt. Fl. Car. 215. 1788.
Bidens chrysanthemoides Michx. Fl. Bor. Am. 2:136. 1803.
Bidens quadriaristata DC. Prod. 5:595. 1836.

Specimens of this species examined and compared with Iowa plants were from the herbaria of the Missouri Botanical Garden and the Field Museum, Chicago, verified by E. E. Sherff. A typical specimen from California (Pl. XXXIII) resembles the large forms of *B. cernua* in some essential characters, but it was found also to differ in the following respects from them and from other Iowa plants listed under the name *B. laevis*:

Stem: larger, 5-10 dm. tall, erect, more slender in general form, often purple tinged, branches above the middle of the stem, ascending.

Leaves: smaller, elliptic-lanceolate, short-acuminate, somewhat contracted toward the sessile or connate-perfoliate base, serrate, with teeth small and inconspicuous, glabrous, not much paler beneath.

Heads: medium, mostly erect on long slender peduncles, slightly nodding in fruit.

Involucre: bracts about 8, sub-equal, rarely longer than the disk, glabrous or slightly ciliate, margins conspicuously wavy, inner bracts oval, stramineous, purple-tipped, about equal to the disk.

Ray-flowers: large, oval with rounded apex, bright yellow.

Disk-flowers: large, lobes spreading, bright yellow, tube contracted, longer than upper part, stamens exserted.

Chaff: purple-tipped, concave, membranaceous, as long as disk-flowers.

Akenes: 7-9 mm. long, greenish brown, cuneate, convex at summit, slightly carinate, not tuberculate, margin strongly crenate and retrorsely hispid.

Pappus: 2-4 awns, somewhat spreading-erect, more than one half the length of akene, retrorsely barbed.

Difference of opinion exists regarding the distribution of this species. MacMillan [18] gives to it the same wide range as that of *B. cernua*; Britton and brown[19] report it from Quebec to Ontario, Min-

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18 MacMillan, Conway. Metaspermae of the Minnesota Valley. Geol. & Nat'l. Hist. Sur. Minn. Bot. Ser. 1:499. 1892.

19 Britton, N. L. & B. L. Brown. Illustrated Flora of North America. 3:436. 1898.

nesota, south to Florida, Louisiana, Mexico and southern California; Wiegand[20] says that it is really a coast plant, and that except in one or two instances, seems never to have penetrated far inland; Sherff[21] confines it to the central southern coast areas; in Gray's Manual, 7th edition, its range is given as near the coast from Massachusetts southwest, also in New York.

No plants from the field nor any Iowa specimens from the herbaria conform to the authentic specimens examined.

The following authors report it as frequent throughout Iowa in wet places, such as swamps, margins of pools and river banks: Arthur (1), Cratty (6), Fink (10), Fitzpatrick (12, 13), Geiser (15), Greene (17), Hitchcock (20), Oleson and Somes (27), Pammel (30), Peck (40), Shimek (15), Somes (56).

The writer assumes that these reported plants are the larger forms *B. cernua* with heads erect just coming into flower, as suggested by Wiegand.

BIDENS DISCOIDEA (T. & G.) Britton.
Bull. Torr. Bot. Club 20:281. 1893.

Coreopsis discoidea T. & G. Fl. N. Am. 2:339. 1842.

The specimens used in the study of the species *B. discoidea* were from the herbariam of the Field Museum and from the Missouri Botanical Garden, verified by E. E. Sherff.

The writer secured plants along the canal near Lake West Okoboji which seemed to conform to the type, particularly in the akenes with the upward hispidity and antrorsely barbed awns. This view was later abandoned, the plants being designated as the smooth 3-divided leaf form of *B. frondosa* L. with antrorse awn character, var. *anomala* Porter.

The most reliable characters distinguishing the species from *B. frondosa* are found in the smaller thinner 3-foliate leaves with long petioled terminal segment, the smaller heads on short peduncles, the four bracts, usually not foliaceous, and the antrorse hispidity on the small narrow akenes and two small awns. Additional points of distinction are listed in the following description:

Stem: slender to robust, reddish above, freely branched.

Leaves: 3-divided, the lateral segments either sessile or slender-

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[20] Wiegand, Karl M. Some Species of Bidens. Bull. Torr. Bot. Club 26:399-401. 1899.

[21] Sherff, E. E. Studies in Bidens III. Bot. Gaz. 61:495-506. 1916.

petioled, coarsely serrate, the teeth mucronulate, long acuminate, membranaceous, glabrous; both lower and upper leaves may be undivided.

Heads: small, discoid, numerous, paniculate-corymbose at ends of very short slender peduncles.

Involucre: outer bracts 3-5, usually 4, linear-spatulate, obtuse, usually longer than the disk but not foliaceous, smooth, not ciliate toward base; inner bracts equalling the disk.

Disk-flowers: orange, 5-lobed, small, equalling or smaller than the awns, stamens slightly exserted.

Chaff: slender, deciduous with akenes.

Akenes: small, 4-5 mm. long, black, narrowly cuneate to oblong, slightly contracted at summit, upwardly strigose, tuberculate or almost smooth.

Pappus: 2 erect stout awns ¼-½ as long as akene, antrorsely hispid, occasionally retrorse.

Because of the antrorse hispidity of the akene and awns, *B. discoidea* was originally classed in the genus *Coreopsis*. Britton, in 1893, transferred it to the genus *Bidens* because it possessed true awns.

Like *Bidens frondosa*, *B. discoidea* grows in low ground, on wet banks, swamps and in old sphagnum bogs. It blooms from August to October.

Its range is said to be not so wide as that of *B. frondosa*. It is common in northern New York to Virginia, south to Carolina, westward to Michigan, Ohio, Louisiana, and Texas, less common in its eastern range and rare in New England. Dr. E. E. Sherff and others assert that the species does not exist in Iowa and that the 3-foliate forms so commonly found are variations of *B. frondosa*.

It is reported in Iowa as common in eastern and southern parts (Pammel, 36) and from the state of Iowa (17, 34, 36).

Bidens coronata (L.) Fischer.

Steud. Nom. Ed. 2:202. 1840.

Coreopsis coronata L. Sp. pl. 2 ed. 1281. 1763.
Coreopsis aurea Ait. Hort. Kew. 3:252. 1789.

Bidens coronata (L.) Fischer is a confusing species seemingly on the border line between *Bidens* and *Coreopsis*. The specimens examined at the Missouri Botanical Garden and the Field Museum,

verified by E. E. Sherff, possessed the following distinctive characters:

Stem: 3-9 dm. tall, erect, slender, glabrous, except near base, diffusely branched.

Leaves: opposite, simple, or 3-7 divided, lateral divisions incised or lobed, small, oblong, flaccid-hairy, on slender petioles.

Heads: 2.5-5 cm. broad, numerous, on slender peduncles in loose terminal panicles.

Involucre: outer bracts linear, spatulate, equalling the disk, slightly shorter than the inner bracts, which are very dark and punctate.

Ray-flowers: 6-10, 1-3 cm. long, golden yellow, obtuse or 5-lobed, often with purple spot at base.

Disk-flowers: numerous, 5-lobed, yellow, narrowed about the middle, stamens exserted, anthers dark.

Akene: 3-4.5 mm. long, flat, one-nerved, broadly cuneate, glabrous or slightly upward-pubescent, not much incurved at top, very narrowly winged.

Pappus: 2 (sometimes 3), teeth blunt.

Root: biennial (Elliott).

Sherff[22] makes the statement that Britton and not Fischer transferred this species to the genus *Bidens*. He says further that Britton, at the time of transferring several species of *Coreopsis* to *Bidens*, assumed that this species had already been removed by Fischer (Steud. Nom. ed. 2:202. 1840). Britton (1893) treated it as a *Bidens* because of its true though blunt awns.

It grows in wet soil, coming into bloom in August and lasting through September.

In the United States, it ranges from Virginia to Florida and Alabama. Dr. N. C. Fassett reports it from Wisconsin. It is not included in the area covered by Gray's Manual, 7th edition, nor in Iowa.

It is reported, erroneously, without a doubt, from the counties of Boone (8), Scott (4), Iowa (36), Cerro Gordo (34), Worth (34), Emmett (34) and from the state of Iowa (17).

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22 Sherff, E. E. Studies in Bidens I. Bot. Gaz. 56: 495. 1913.

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INDEX TO SPECIES

Page

Bidens L. 376
acuta Wieg. 383
aristosa (Michx.) Britton 391
Beckii Torr. 389
bipinnata L. 388
cernua L. 380
chrysanthemoides Michx. 396
comosa (A. Gray) Wieg. 383
connata Muhl. 381
coronata (L.) Fischer 398
discoidea (T. & G.) Britton 397
frondosa L. 385
gracilis Greene 380
involucrata (Nutt.) Britton 393
laevis (L.) BSP. 396
melanocarpa Wieg. 385
minima L. 380
petiolata Nutt. 381
quadriaristata DC. 396
riparia Greene 383
trichosperma (Michx.) Britton 394
tripartita Bigl. 381
vulgata Greene 386
Wallichii DC. 388

Megalodonta Greene 389
Beckii (Torr.) Greene 389
nudata Greene 389

coreopsis L. 372
aristata Muhl. 391
aristosa Michx. 391
aurea Ait. 398
aurea Lindl. 394
bidens L. 380
bidens Walt. 396
coronata L. 398
discoidea T. & G. 397
involucrata Nutt. 393
palmata Nutt. 375
pauciflora Lehm. 375
praecox Fresn. 375
trichosperma Michx. 394
tripteris L. 374

Chrysostemma 374
tripteris (L.) Less. 374

Diodonta 394
coronata Nutt. 394

Helianthus L. 339

Page

altissimus DC. 360
altissimus L. 354
annuus L. 343
aridus Rydb. 344
atrorubens Lam. 348
atrorubens L. 370
canescens Michx. 351
crinitus Steud. 354
decapetalus L. 361
decapetalus Darl. 360
divaricatus L. 358
diversifolius Ell. 357
doronicoides Lam. 369
doronicoides T. & G. 364
esculentus Warcz. 364
frondosus L. 361
giganteus L. 354
gigas Michx. 354
grandiflorus Juss. 361
grandiflorus Wender. 343
grosseserratus Martens 352
heterophyllus Nutt. 349
hirsutus Raf. 357
hispidulus Ell. 357
Hookeri G. Don 369
illinoensis Gleason 349
indicus L. 343
integrifolius Nutt. 344
laetiflorus Pers. 348
laevis L. 396
laevis Walt. 360
lenticularis Dougl. 343
macrocarpus DC. 343
macrophyllus Willd. 360
Maximiliani Schrad. 355
mollis Lam. 351
mollis Willd. 360
mollissimus Watson 367
multiflorus L. 361
neglectus Otto 360
occidentalis Ridd 349
ovatus Lehm. 343
patens Lehm. 344
petiolaris Nutt. 344
pilosus Tausch 369
platycephalus Cass. 343
prostratus Willd. 363
pubescens Vahl. 351
rigidus (Cass.) Desf. 346
scaberrimus Ell. 346
scrophulariaefolius Britton 361
sparsifolius Ell. 370

	Page
spathulatus Ell.	368
squarrosus Nutt.	368
strumosus L.	360
strumosus Willd.	361
subcanescens (Gray) Watson	367
subtuberosus Bourg.	355
tenuifolius Ell.	361
tomentosus Michx.	368
tracheliifolius Mill.	363
trachyphyllus T. & G.	357
tricuspus Ell.	348
truncatus Schwein.	358
tubaeformiss Nutt.	343
tuberosus L.	364
tuberosus Parry	354
virgatus Lam.	354

Plate XXIV
HELIANTHUS PETIOLARIS Nutt. Habit; chaff; disk-flower and akene; akene, nearly mature.

Plate XXV
HELIANTHUS SCABERRIMUS Ell. Habit; involucral bract; chaff; disk-flower and akene.

Plate XXVI
HELIANTHUS LAETIFLORUS Pers. Habit; involucral bract; chaff; disk-flower and akene; root and tubers.

Plate XXVII
HELIANTHUS OCCIDENTALIS Ridd. Habit; involucral bract; chaff; disk-flower and akene.

Plate XXVIII
HELIANTHUS MOLLIS Lam. Inflorescence; ray flower; disk-flower and akene; chaff; involucral bract.

Plate XXIX
HELIANTHUS GIGANTEUS L. Habit; involucral bract; chaff; disk-flower and akene.

Plate XXX
HELIANTHUS MAXIMILIAMI Schrad. Habit, showing crown bud (a) and portion of root; involucral bract; chaff; disk-flower and akene.

Plate XXXI
HELIANTHUS HIRSUTUS Raf. Habit; involucral bract; chaff; disk-flower and akene.

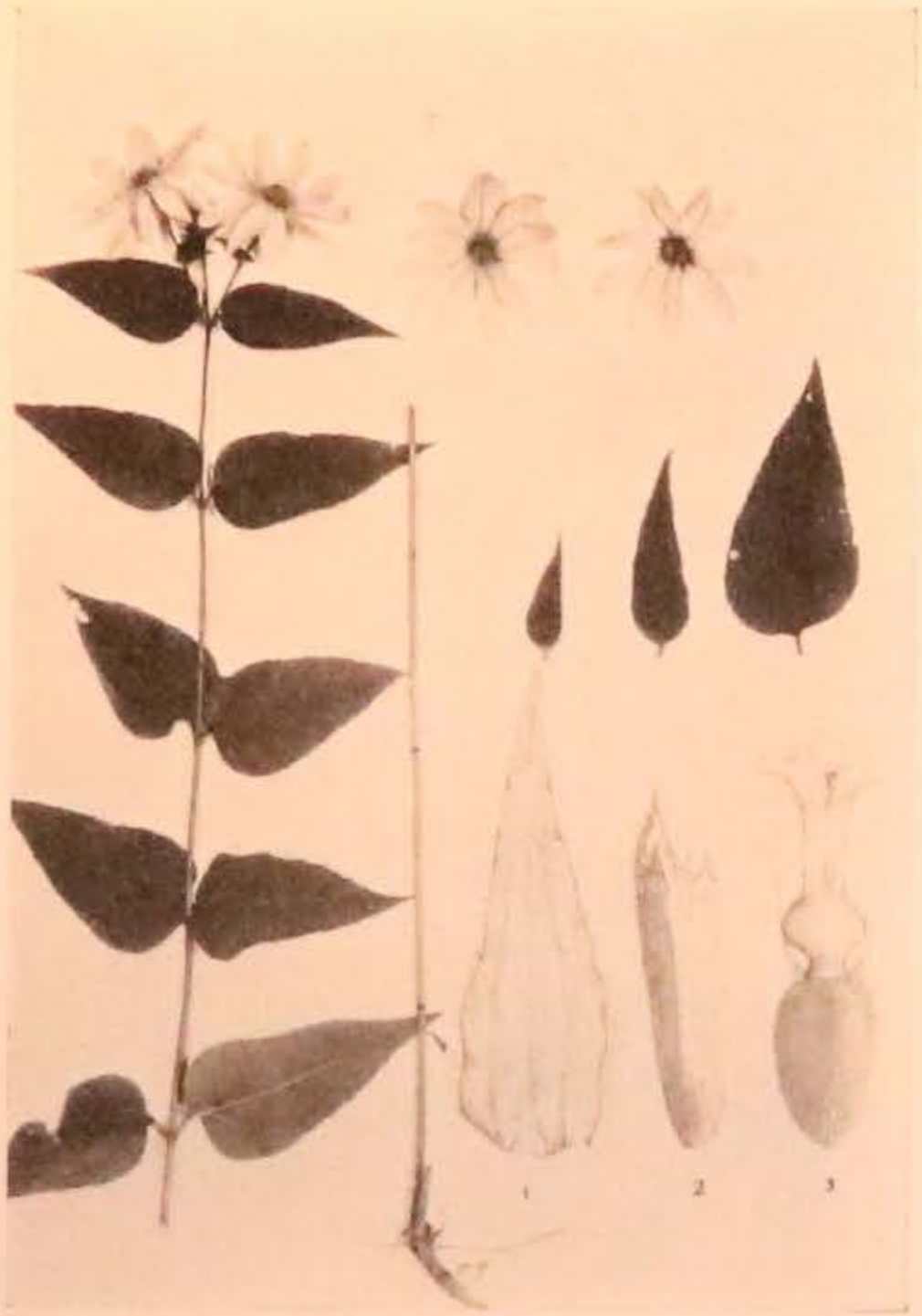

Plate XXXII
HELIANTHUS DIVARICATUS L. Habit; involucral bract; chaff; disk-flower and akene; root.

Plate XXXIII
HELIANTHUS STRUMOSUS L. Habit; involucral bract; chaff; disk-flower and akene; root.

Plate XXXV
HELIANTHUS TRACHELIFOLIUS Mill. Habit; involucral bract; chaff; disk-flower and akene; root and branching rhizomes.

Plate XXXIV
HELIANTHUS DECAPETALUS L. Habit; involucral bract; chaff; disk-flower and akene.

Plate XXXVI
HELIANTHUS DORONICOIDES Lam. Habit; involucral bract; chaff; disk-flower and akene.

Plate XXXVII
COREOPSIS PALMATA Nutt. Habit; disk-flower; mature akene; outer involucral bract; inner involucral bract; chaff.

Plate XXXVIII
BIDENS CONNATA Muhl. Habit; disk-flower and akene; mature akene; outer involucral bract; inner involucral bracts; tripartite leaf.

Plate XXXIX
BIDENS COMOSA (Gray) Wiegand. Habit; inner involucral bracts; disk-flower and akene.

XL
BIDENS FRONDOSA L. Habit; inner involucral bract; disk-flower and akene.

Plate XLI
BIDENS VULGATA Greene. Habit; inner involucral bracts; disk-flower and akene.

Plate XLIII
BIDENS BECKII Torr. Habit; inner involucral bract; disk-flower; immature akene.

Plate XLII
BIDENS BIPINNATA L. Habit; disk-flower and akene; mature akene; outer involucral bract; inner involucral bract.

Plate XLIV
BIDENS ARISTOSA (((Michx.) Britton. Habit; BIDENS ARISTOSA (Michx.) Britton. Habit; disk-flower; akene; outer involucral bracts; inner

Plate XLV
I. BIDENS ARISTOSA var. FRITCHERI Fernald (above). II. BIDENS ARISTOSA var. MUTICA Gattinger (below).

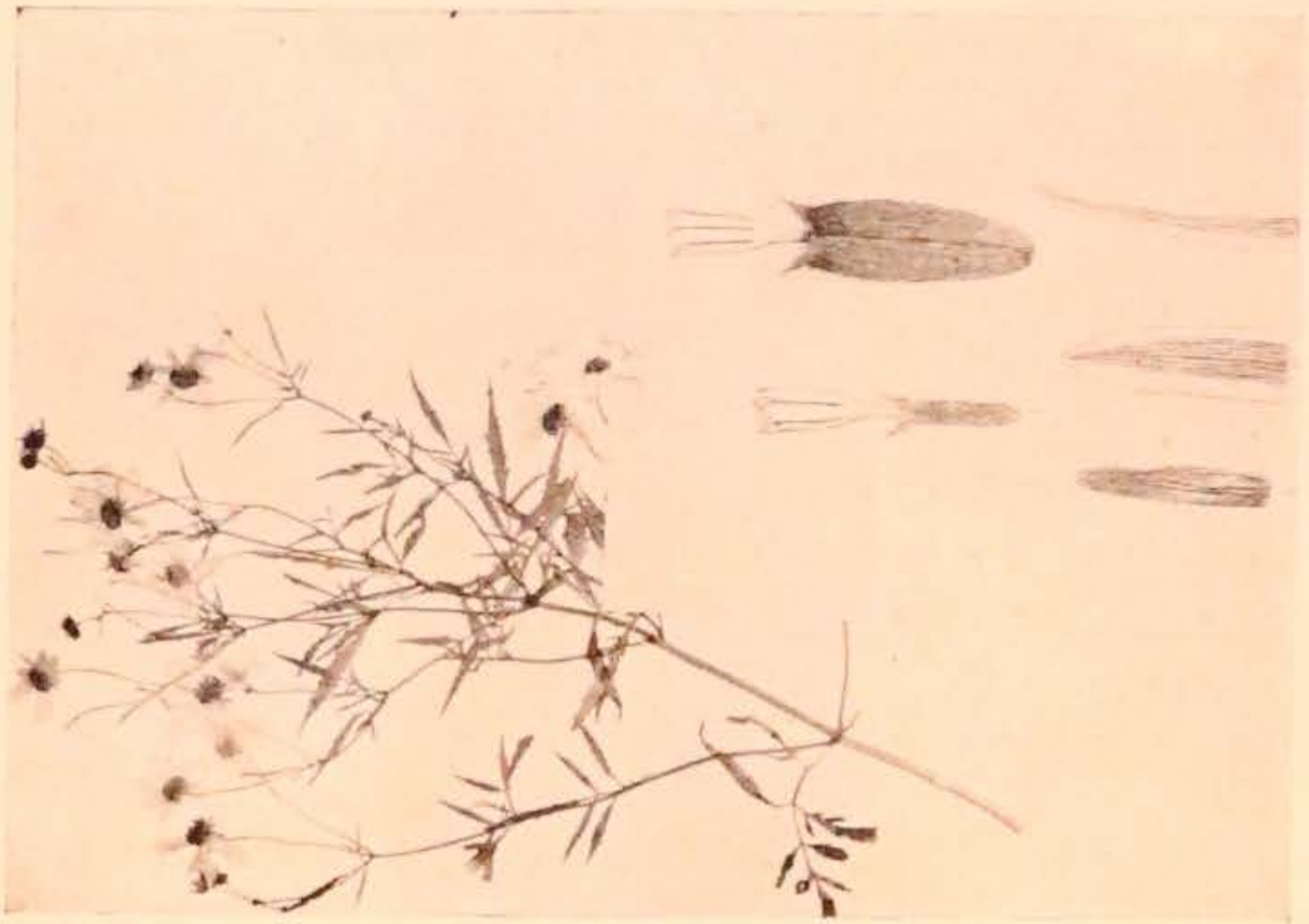

Plate XLVII
BIDENS TRICHOSPERMA (Michx.) Britton. Habit; disk-flower with sterile akene; disk-flower with fertile akene; outer involucral bract; inner involucral bracts.

Plate XLVI
BIDENS INVOLUCRATA Nutt.) Britton. Habit; disk flower; akene; outer involucral bract; inner involucral bracts.