

Hybridization of perennial sunflowers in Indiana¹

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During the course of a field study of perennial sunflowers in Indiana, a number of naturally occurring interspecific hybrids were found. The most extensive investigation was carried out in the Lake Area where a number of the species native to the state may often be found growing in close proximity to each other. Previously, Smith (1952) and Long (1954) have reported natural hybrids between certain of the perennial species of *Helianthus* found in Indiana. However, in the present study six new hybrid combinations are listed as occurring naturally. Inasmuch as some of the hybrids were found to occur frequently a detailed description of their morphology and ecology is given. It is believed that these descriptions will be of considerable aid to future workers in Indiana flora.

Representative specimens of the hybrids listed here are deposited in the Herbarium of Indiana University and in the Herbarium of Purdue University.

Helianthus mollis x *H. occidentalis* (fig. 1)

Perennial; stem 0.5-2.0 m. high, strigose-hispid to velutinous, either more leafy than *H. occidentalis* below or sparingly so throughout; leaves sessile, the medium ones opposite, oblong-ovate, broadly decurrent to cuneate at the base, the apex acute to slightly obtuse, scabrous-hispid above, ashy and strigose beneath; inflorescence of one or many heads, in the latter case the peduncles are alternate, pubescence of the peduncles hispid and variable in length; head diameter across the disc. 0.9-2.0 cm., rays 10-20, conspicuous, phyllaries lanceolate, loose, and spreading, equal to or exceeding the disc, scabrous-hispid to villous; rhizome slender, roots fibrous.

Hybrids of this combination have been collected in Starke, White, Jasper, Cass, and Pulaski Counties. In these areas *Helianthus mollis* Lam. and *H. occidentalis* Riddell were generally found on open sand ridges around cultivated fields or along railroad right-of-ways. In most instances wherever the two species were found growing together natural hybrids could be located. The size of the hybrid population varied from eight individuals to over one-thousand in an exceptional case. The average hybrid population consisted of about three hundred individuals. Altogether fourteen different populations were located, and sample collections were made of most of them.

Although there was considerable morphological variation in and among the various hybrid populations, the description which is given is designed to include all variation observed.

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Helianthus mollis x *H. grosseserratus* (fig. 2)

Perennial; stem 0.5-1.0 m. high, scabrous-hirsute, branched above in large individuals, the branches ascending; leaves opposite below and to the median part of the stem, becoming alternate and gradually smaller above, sessile, acute to obtuse at the apex, the base cuneate, the two main lateral veins diverging from the midrib 0.8-2.7 cm. from the base in median leaves, sparsely to densely scabrous-hispid above and below; inflorescence of one to several heads, the peduncles alternate, medium to stout; heads 0.9-2.5 cm. across the disc, phyllaries lanceolate to broadly so, shorter than or sometimes exceeding the disc, puberulous to scabrous-tomentose on the back; rhizome stout, roots fibrous and abundant.

Only one hybrid population between *H. mollis* and *H. grosseserratus* Martens was found in two summers of field work. Both species are commonly found together along railroad right-of-ways and fence-rows. Doubtless this hybrid rarely occurs naturally. The population sampled contained 153 individuals and was growing between highway 421 and the railroad tracks 0.8 miles north of Chalmers in White County. In this area *H. grosseserratus* usually flowers later than *H. mollis*. However, mowing of the area between the railroad and highway sometimes causes the cut-over plants of *H. mollis* to produce lateral shoots which flower later than normal. It is quite probable that this resulted in the formation of the hybrids which were found. Seeds collected from the putative hybrids were grown in the greenhouses at Purdue University and yielded a number of plants very much like the parental species while others were variously intermediate. A great many of the progeny were decidedly different from any of the hybrids collected in the field.

Helianthus mollis x *H. giganteus* (fig. 3)

Perennial; stem 1.0-2.0 m. high, scabrous to hirsute, usually branched above; leaves opposite at the median part of the stem, alternate and smaller above, sessile, lanceolate to elliptic in shape, cuneate at the base, scabrous-strigose or hispid above, softly tomentose to hirsute beneath; inflorescence an open lax panicle, branches ascending, peduncles leafy, and usually densely pubescent; head diameter 1.5-2.0 cm. across the disc, rays 16-23, phyllaries linear-lanceolate, densely hispid-hirsute and spreading ciliate, loosely ascending, and longer than the disc; rhizomes short and stout, roots fibrous.

Helianthus giganteus L. is usually found in more moist habitats than the other species. In the northern part of the state it has been collected in bogs, along lake edges and streams, and in low wet pastures. Where these habitats bound the somewhat drier and more open habitat of *H. mollis*, hybrids between the two species are often found. This is especially true where such areas have been recently and extensively disturbed.

Hybrids between *H. mollis* and *H. giganteus* have been collected in Starke, Sullivan, and Marshall Counties. Specimens for the latter two counties were collected by C. C. Deam and are in the Indiana University Herbarium. As a rule, hybrid populations of these two species were rather small, sometimes consisting of as few as one or two clones. The

largest population contained twenty-six clones, and this was in a recent disturbed habitat.

Helianthus mollis x *H. divaricatus* (fig. 4)

Perennial; stem 0.5-1.5 m. high, hispid; leaves opposite, sessile, subcordate to broadly ovate, broadest at the base, the two main lateral veins diverging from the midrib 0.2-0.5 cm. from the base, hirsute to scabrous above and below; head diameter 0.9-2.0 cm. across the disc, rays 12-17, phyllaries broadly lanceolate, equal to or exceeding the disc, loose, velutinous to villous; inflorescence cymose or racemose or at times consisting of a single head; rhizomes abundant and thin, roots fibrous.

H. divaricatus L. is usually found in woods openings and along their edges. This species has been found to hybridize with *H. mollis* in such areas of disturbance as cut-over woodlands and fence-rows, and along roadsides at the edges of woods. A rather large population of hybrids was located at the edge of the Jasper-Pulaski State Game Preserve. *H. divaricatus* grew along the edge of the woods while *H. mollis* was found on the levee of a drainage ditch in the open. The hybrids were growing between the two species populations in a fire lane. Hybrids were found in similar habitats in other areas of Pulaski and Starke Counties.

Helianthus occidentalis x *H. grosseserratus* (fig. 5)

Perennial; stem 1.0-1.3 m. high, slightly scabrous below, becoming more pubescent above; leaves of the median part of the stem opposite, becoming alternate above, ovate-lanceolate with an attenuated base ending in a distinct petiole, scabrous beneath and only slightly so above; inflorescence cymose-paniculate, the branches rather long, peduncles slender, hispid with upwardly appressed trichomes; heads about 1.6 cm. across the disc, rays about fourteen; phyllaries ciliate, puberulous on the backs, somewhat exceeding the height of the disc, lanceolate and slightly acuminate; rhizomes slender, roots fibrous.

Two natural hybrids between these two species were found. They were located approximately 3.7 miles north of Monon in White County between highway 421 and the railroad track. The soil was sandy and very few plants of *H. grosseserratus* were growing in the immediate vicinity.

Helianthus occidentalis x *H. divaricatus* (fig. 6)

Perennial; stem 1.0-1.3 m. high, pubescence on the upper part of long puberulous and shorter upwardly appressed trichomes; leaves opposite, lanceovate with an attenuate base, petiole up to 2 cm. long, the two main lateral nerves diverging from the midrib 0.2-2.5 cm. from the leaf base, some plants having sessile leaves with an attenuate-cuneate base, pubescence of the leaves scabrous above and below, the trichomes fine and rather long; inflorescence corymbose-paniculate with the branching mostly opposite, peduncles long, slender, and hispid, in small plants the inflorescence consisting of one or two heads, head diameter 0.8-1.2 cm. across the disc, rays 9-14, phyllaries lanceolate with

ciliate margins, scabrous on the back and midrib, longer than the disc and somewhat loose; rhizome up to 0.5 cm. thick in dried specimens, roots fibrous.

Apparently natural hybridization between *H. occidentalis* and *H. divaricatus* does not occur readily. A large number of mixed populations of the two species were examined over a two year period, and only two hybrid populations were located. Each population consisted of approximately twenty individuals. However, the two populations were somewhat different from each other in morphological characteristics so that some segregation had evidently occurred. One population was located in a cut-over woodland at the southcentral part of the Tippecanoe River State Park along highway 35. Both populations occurred in Pulaski County.

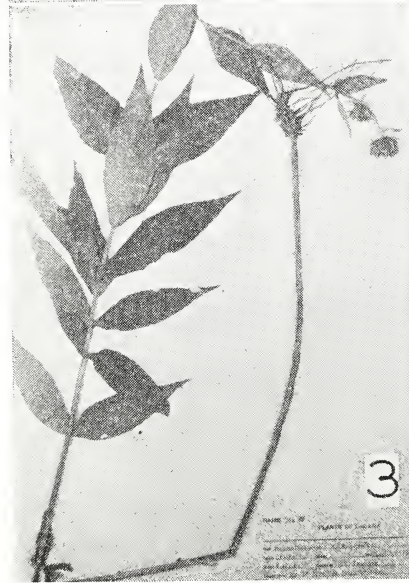
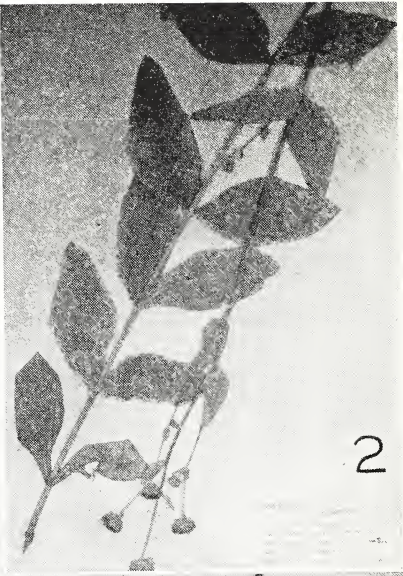
Probably the plant habitats in the part of northern Indiana studied were not greatly disturbed until an adequate drainage system for the wetter areas was developed. In Starke County this occurred in 1892 and 1901 (Grimes et al., 1917). Until this period farming was mostly on the higher sand ridges. With the advent of agriculture on a more extended basis, woodlands were cut over and a great number of new plant habitats were developed. Where such disturbance occurred, hybrids between a number of the species listed here were produced. That some of the hybrid populations are quite old is borne out by the fact that one frequently finds the hybrids of *H. mollis* and *H. occidentalis* in well developed second growth timber. Such hybrids do not attain maximum growth in this habitat and will probably not persist much longer. However, the presence of hybrids between two heliophytic species in such shaded habitats would seem to indicate that they were not of recent origin.

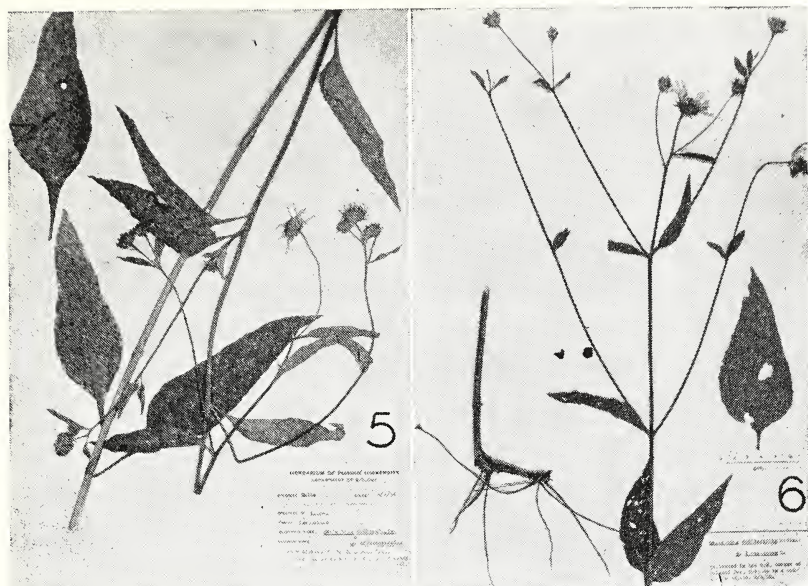
Although there is no doubt of the authenticity of the natural hybrids which have been collected, an attempt has been made to produce all of them artificially. Thus far the following interspecific hybrids have been synthesized by the writers: *H. mollis* x *H. giganteus*, *H. mollis* x *H. divaricatus*, *H. mollis* x *H. grosseserratus*, and *H. mollis* x *H. occidentalis*. Seed for other crosses has been obtained, but it has not been grown yet. Detailed data on the fertility and cytology of natural and artificial hybrids presented here are given by Jackson (1955).

Summary

Six naturally occurring interspecific hybrids of *Helianthus* are reported for Indiana. Detailed descriptions of the hybrids, and notes on their occurrence and ecology are presented. Some of the hybrids, notably *H. mollis* x *H. occidentalis* and *H. mollis* x *H. giganteus*, are rather common in some areas.

It is suggested that the production of some of the hybrids considered here may have begun in the late 1800's with the advent of increased agricultural practices which resulted in the production of new disturbed habitats.



Fig. 1. *Helianthus mollis* x *H. occidentalis*Fig. 2. *Helianthus mollis* x *H. grosseserratus*Fig. 3. *Helianthus mollis* x *H. giganteus*Fig. 4. *Helianthus mollis* x *H. divaricatus*Fig. 5. *Helianthus occidentalis* x *H. grosseserratus*Fig. 6. *Helianthus occidentalis* x *H. divaricatus*

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