

THE COMPOSITAE OF THE OAK OPENINGS

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ABSTRACT

This report is the first of a series of articles to be prepared as a second "Flora of the Oak Openings." The first floral survey of the Oak Openings region in western Lucas County, Ohio, was made by Edwin L. Moseley in 1928. During the present investigation, collecting was done at eight major sites, representing the habitats of the Oak Openings region.

Of the 113 taxa annotated in this study, 88 taxa have been found by the present investigator (1970). Nineteen taxa were reported by Moseley that were not found in this study; twenty were found during the present investigation that were not reported by Moseley. Eight taxa are more common now than in Moseley's time (1928); twelve are less common now (1970) than in Moseley's time. The reasons for these changes are not known, but some probable explanations are: (1) some species have come in along Swan Creek and have established themselves in the floodplain; (2) some species are adventive; (3) man-made changes along roadsides, in cultivated fields, and in housing developments have altered the habitats; and (4) a more thorough investigation of the Oak Openings may change some of Moseley's records.

INTRODUCTION

Most of the original vegetation in Ohio was hardwood forest; in northwest Ohio, much of this forest was Elm-Ash Swamp Forest or Beech Forest, with treeless areas, or "prairies", scattered throughout some regions of the woodlands (Gordon, 1966). Wet open spaces, called later "wet prairies", formed a mosaic pattern in many parts of the forests (Transeau, 1935). Sears (1926) mentions the "oak savannahs", in which oaks form open groves on higher ground, with grasses and other herbs occupying the lower ground.

In western Lucas County, an extensive deposit of sand runs diagonally across Swanton, Spencer, and Sylvania townships. Similar sand deposits extend into southeastern Michigan (Forsyth, 1968b) and into Fulton County (Gordon, 1966). The sand probably was deposited in the ancient glacial Lake Warren. When the lake level lowered, much of the sand was blown into dunes, some as much as 45 feet high. Between the dunes, the sand was much shallower, and much closer to the impermeable clayey till which underlaid the sand. The sand above this impermeable clayey till became saturated with rain water, but only in the lower areas did this water reach the surface (Forsyth, 1968a). The higher, dry-sand areas were covered with oaks, mostly scattered Black Oaks with denser stands of White Oaks (Easterly, 1969). The low, wet-sand areas formed wet prairies.

The best-preserved wet-prairie remnant is Irwin Prairie in Spencer Township. The present site is one-half mile wide along Irwin Road and three-fourths mile long between Bancroft Street and Dorr Street. The water table in the prairie may vary from eight inches above the surface of the ground in the spring to 18 inches below the surface in late summer (Lindsay, 1965).

The earliest published list of plants from the Oak Openings was by Edwin L. Moseley; it was published in 1928 and was entitled "Flora of the Oak Openings". The work was essentially a check list of species, with introductory remarks concerning the characteristics of and changes within the Oak Openings habitats. The boundary, as drawn by Moseley (fig. 1), included approximately 130 square miles of western Lucas County, southeastern Fulton County, and northeastern Henry County.

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This paper is the first of a series of reports to be prepared as a second "Flora of the Oak Openings." The primary objective in all of these reports will be to identify the vascular plants present in the Oak Openings now, and to determine any significant changes that have taken place in the flora since 1928. The flora has been divided into manageable units: (1) the Compositae, representing the largest number of species in any family listed by Moseley; (2) the grasses and grass-like plants, representing perhaps the most difficult unit to present taxonomically; (3) the woody plants; (4) the herbaceous plants, excluding Compositae, Gramineae, Cyperaceae, and Juncaceae; and (5) a special consideration of Irwin Prairie, one of the representative habitats of the Oak Openings.

COLLECTING SITES AND METHODS

Much of the original Oak Openings has been lost to cultivation and urban growth. Moseley (1928) mentions the construction of a large, deep ditch which would make possible the drainage of adjacent farm lands. Goff (1968) states that crushed limestone, used as the foundation of roadbeds, has changed the pH of the soil along the highways from its original acid condition to a more alkaline condition. The construction of homes, the planting of trees around the homes, and the removal of trees to prepare homesties all have caused changes which have affected the original vegetation.

These changes have reduced the number and quality of good plant-collecting sites. The city of Toledo has preserved 3260 acres in Swanton Township as "The Oak Openings Metropolitan Park." To the west and southwest of Whitehouse, Ohio, and extending into Fulton and Henry Counties, lies the Maumee State Forest, another good area in which to observe plants. There are several other excellent sites outside the boundaries of the metropolitan park and state forest. A sand-dune area adjacent to wet woods is located in Waterville Township along Davis Road near Obee Road. A larger sand-dune-and-wet-woods site is located on Reed Road near its junction with Whitehouse-Spencer Road. Other similar sites are found along Eber Road approximately two miles north of Whitehouse.

The Wabash Railroad, from Monclova due west through the Oak Openings Park and on into Fulton County, offers an excellent transect of the oak openings habitats. The wet railroad ditch is bordered by sand dunes in some localities, and by wet woods and wet prairies in other places.

The floodplain along Swan Creek is another important collecting site. It runs diagonally from northwest to southeast through the Oak Openings Park, and then northeast through the city of Toledo into the Maumee River. The gradient of the stream is very gentle, 2.1 feet per mile (Forsyth, 1968b). Some destructive flooding has occurred along this stream in the past, but construction of drainage ditches and tiling of the farm land has reduced the destructiveness of most floods.

Most of the 130 square miles, outlined by Moseley in 1928 (fig. 1) as being part of the Oak Openings, were surveyed by automobile during the past six years. Plant specimens were collected along or near the roadsides on these trips, but the major collecting efforts were made in the following sites: (1) in undisturbed regions of the metropolitan park (with special permission), (2) in Maumee State Forest, (3) along Davis Road, (4) along Reed Road, (5) along Eber Road, (6) along the Wabash Railroad, (7) along Swan Creek floodplain, and (8) in Irwin Prairie.

Voucher specimens for the present study have been stored in the Herbarium at Bowling Green State University. Duplicates have been sent to the Herbarium at Oberlin College, Oberlin, Ohio. All Compositae from Lucas County preserved in the Herbarium of The Ohio State University were also studied. Voucher specimens of Moseley's work are stored in the Herbarium at Bowling Green State University.

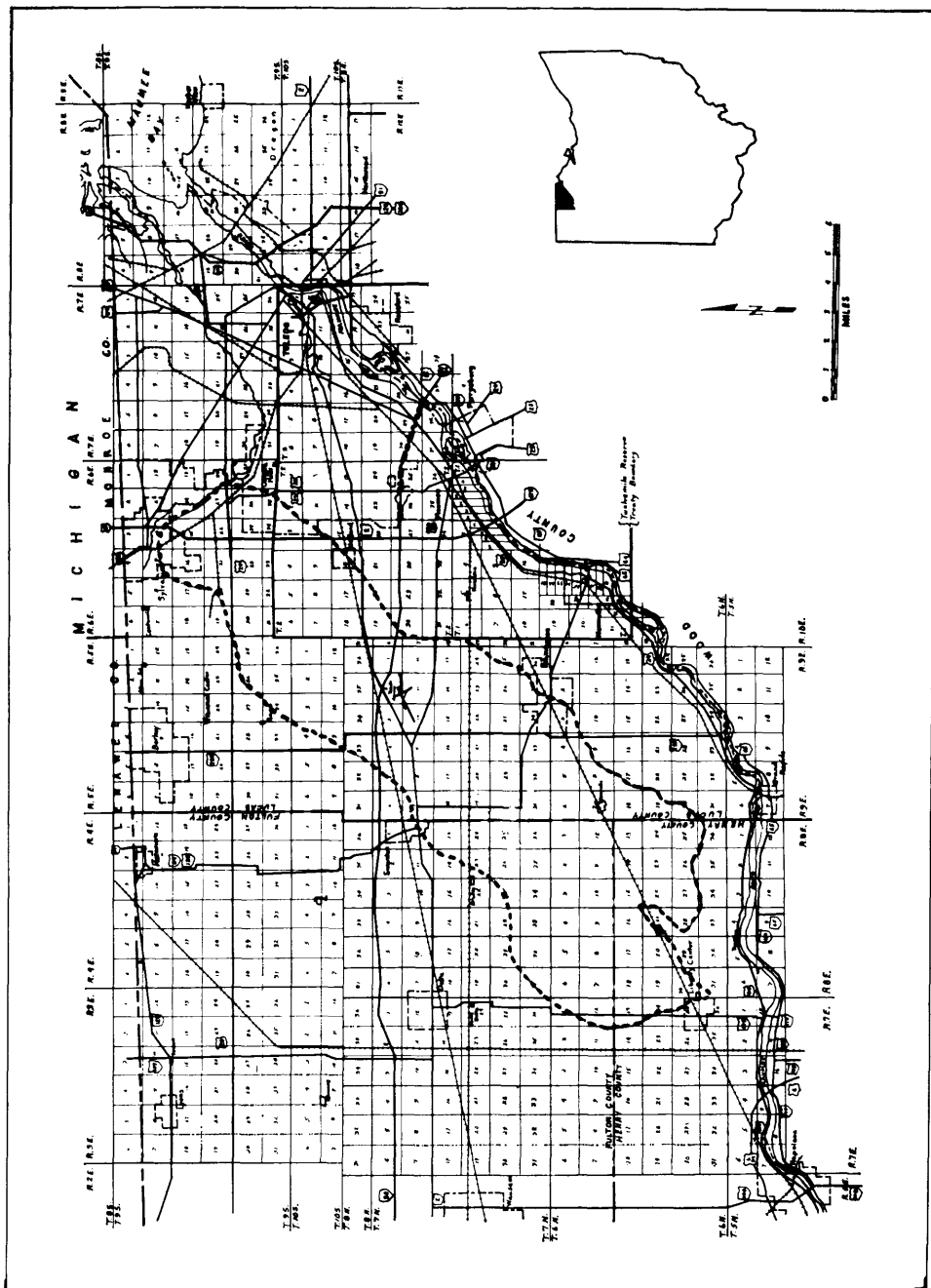


FIGURE 1. Outline of the Oak Openings, as studied by Moseley (1928). Map prepared by Daniel W. Hehr, Department of Biology, College of Steubenville, Steubenville, Ohio 43952.

Moseley (1928) used the following code to describe the frequency of occurrence of the plant species in the Oak Openings: (1) *rare*, seen in less than 5 places; (2) *scarce*, seen in less than 15 places; (3) *infrequent*, seen several times during a day's field trip; (4) *frequent*, a few thousand plants per square mile; (5) *common*, many thousands of plants per square mile; (6) *abundant*, hundreds of thousands of plants per square mile; and (7) *local*, many plants in a few places, elsewhere few or none. In places, Moseley made no comment after the species citation in his check list, which probably indicated either that he hadn't adequately noticed the species, that he may have overlooked it, or that he failed to visit the habitat in the right season (Moseley, 1928, p. 93).

THE ANNOTATED CHECK LIST

This list includes the habitat, identification of introduced species, comparison of the frequency of occurrence in Moseley's time (1928) and the present (1970), and the citation of synonyms used by Moseley for the species taken from the seventh edition of Gray's *New Manual of Botany* (Fernald, 1908). Species marked by an asterisk were in the list of species that were more common in the Oak Openings than in all the rest of Ohio. Nomenclature in this study follows that of the eighth edition of Gray's *Manual of Botany* (Fernald, 1950). Other publications consulted were those by Heiser (1969), Fisher (1957), and Speer (1958). Unless otherwise stated, the specimens were collected in late summer and autumn.

1. *Achillea millefolium* L. Common Yarrow.
Roadsides, railroad embankment, cultivated areas. Naturalized from Europe.
ELM: frequent; NWE: frequent.
2. *Ambrosia artemisiifolia* L. var. *elatio* (L.) Des. Common Ragweed.
Roadsides, cultivated areas. ELM: common; NWE: common.
3. *Ambrosia trifida* L. Great Ragweed.
ELM: Listed, but no specimens available for study; NWE: no specimens collected.
4. *Antennaria neglecta* Greene Pussy's-toes.
Dry, sandy areas. ELM: frequent; NWE: frequent. Spring.
5. *Antennaria plantaginifolia* (L.) Hook. Pussy's-toes.
Dry roadsides, ditches. ELM: common; NWE: infrequent, not as numerous as No. 4. Spring.
6. *Arctium minus* (Hill.) Bernh. Common Burdock.
Naturalized from Europe. ELM: listed, but no specimens for study; NWE: no specimens collected.
7. *Artemisia vulgaris* L. Common Mugwort.
Naturalized from Europe. ELM: listed as rare escape, but no specimens for study; NWE: no specimens collected.
- *8. *Aster azureus* Lindl. Azure Aster.
Dry sandy fields. ELM: abundant; NWE: abundant.
9. *Aster cordifolius* L. Heart-leaved Aster.
Edge of moist woods, Reed Road. ELM: not listed; NWE: scarce.
10. *Aster junciformis* Rydb.
ELM: common, as *Aster junceus* of ed. 7, not Ait.; NWE: Moseley's specimens key out to *Aster vimineus* Lam.
11. *Aster laevis* L. Smooth-leaved Aster.
Dry sand, fields. ELM: common, NWE: common.
12. *Aster lateriflorus* (L.) Britt.
ELM: infrequent, as *Aster diffusus* Ait., no specimens available for study; NWE: no specimens collected.
13. *Aster macrophyllus* L. Large-leaved Aster.
Moist open woods. ELM: frequent; NWE: frequent.
14. *Aster novae-angliae* L. New England Aster.
Roadside ditches, edge of moist woods. ELM: common, NWE: frequent.
15. *Aster pilosus* Willd. var. *pilosus*.
Roadsides, ditches, cultivated area, dry sand. ELM: frequent, as *Aster ericoides* of ed. 7, not L.; NWE: common.
16. *Aster pilosus* Willd. var. *platyphyllus* (T. & G.) Blake.
Dry sand, fields, roadsides. ELM: frequent, as *Aster ericoides* L. var. *platyphyllus* T. & G.; NWE: infrequent.
- *17. *Aster praealtus* Poir.
Moist fields, ditches, wet prairie. ELM: common, as *Aster salicifolius* Ait.; NWE: common.
18. *Aster puniceus* L. var. *puniceus*.
Roadside ditches, moist fields, floodplain. ELM: common, as *Aster lucidulus* (Gray) Wieg.; NWE: common. Moseley refers to two varieties, but John Speer (1958) places both of them in this taxon.

19. *Aster sagittifolius* Weden. Arrow-leaved Aster.
Roadside ditches, moist woods. ELM: infrequent; NWE: frequent.
20. *Aster simplex* Willd. var. *simplex*.
Roadsides, dry sandy fields. ELM: common, as *Aster paniculatus* Lam. and *Aster tradescanti* L.; NWE: common.
21. *Aster umbellatus* Mill. var. *umbellatus*.
Wet ditches, edge of wet woods, moist sand. ELM: common; NWE: common.
- *22. *Aster vimineus* Lam. var. *vimineus*.
Wet prairies, wet ditches, floodplain. ELM: listed with no comment; NWE: common. Moseley's specimens of *Aster dumosus* L. key out to *Aster vimineus* Lam.
23. *Bidens cernua* L. var. *cernua*. Stick-tight.
Wet woods, floodplain, edge of ponds. ELM: frequent; NWE: local.
24. *Bidens comosa* (Gray) Wieg. Beggar-ticks.
Moist woods north of Whitehouse. ELM: common; NWE: infrequent.
25. *Bidens connata* Muhl. Swamp Beggar-ticks.
ELM: common; NWE: no specimens collected.
26. *Bidens coronata* (L.) Britt. var. *tenuiloba* (Gray) Sherff.
Wet prairie. ELM: local, as *Bidens trichosperma* (Michx.) Britt. and *Bidens trichosperma* var. *tenuiloba* (Gray) Britt.; NWE: frequent. Moseley lists *Bidens aristosa* (Michx.) Britt., but specimens key out to *Bidens coronata* var. *tenuiloba*.
27. *Bidens frondosa* L. var. *frondosa*. Beggar-ticks.
Wet woods, floodplain. ELM: common; NWE: common.
28. *Cacalia atriplicifolia* L. False Indian Plantain.
Dry sand, edge of dry woods. ELM: infrequent; NWE: infrequent.
29. *Chrysanthemum leucanthemum* L. var. *pinnatifidum* Lecoq. & Lamotte. Ox-eye.
ELM: rare, no specimens available for study; NWE: no specimens collected.
30. *Cichorium intybus* L. Common Chicory.
Naturalized from Europe. Sandy dump site, Reed Road, one specimen. ELM: scarce, no specimens available for study; NWE: rare.
31. *Cirsium arvense* (L.) Scop. Canada Thistle.
Naturalized from Europe. Sandy dump site, Reed Road, one specimen. ELM: frequent; NWE: rare.
32. *Cirsium discolor* (Muhl.) Spreng. Field Thistle.
Wet prairie, wet ditches. ELM: frequent; NWE: frequent.
33. *Cirsium muticum* Michx. Swamp Thistle.
Wet prairie, floodplain. ELM: common; NWE: common.
34. *Cirsium vulgare* (Savi.) Tenore. Bull Thistle.
Naturalized from Europe. Wet ditches, sandy dump site, Reed Road. ELM: infrequent, as *Cirsium lanceolatum* (L.) Hill.; NWE: infrequent.
35. *Coreopsis tripteris* L. var. *tripteris*.
Moist ditches, edge of wet woods. ELM: abundant; NWE: abundant.
36. *Eclipta alba* (L.) Hassk.
ELM: rare, no specimens available for study; NWE: no specimens collected.
37. *Erechtites hieracifolia* (L.) Pers. Fireweed.
Railroad ditch, dump site, Reed Road. ELM: common; NWE: infrequent.
38. *Erigeron annuus* (L.) Pers. White-top.
Roadsides, dry sandy fields. ELM: infrequent; NWE: infrequent. Summer.
39. *Erigeron canadensis* L. Horseweed.
Roadsides, dry fields, cultivated areas. ELM: abundant; NWE: abundant. Summer.
40. *Erigeron philadelphicus* L. Fleabane.
Moist ditches. ELM: listed with no comment; NWE: infrequent. Spring, early Summer.
41. *Erigeron pulchellus* Michx. Robin's-plantain.
ELM: scarce, no specimens available for study; NWE: no specimens collected. One specimen examined from Lucas County, Burtlehaus (1900), Ohio State University Herbarium.
42. *Erigeron strigosus* Muhl. White-top.
Roadsides, dry sandy fields. ELM: frequent, as *Erigeron ramosus* (Walt.) BSP.; NWE: frequent.
43. *Eupatorium altissimum* L. Tall Thoroughwort.
Dry sandy fields, dunes. ELM: not listed; NWE: infrequent.
44. *Eupatorium maculatum* L. Joe-Pye-weed.
Wet ditches along railroad. ELM: common, as *Eupatorium purpureum* L. var. *maculatum* (L.) Darl.; NWE: common.
45. *Eupatorium perfoliatum* L. Boneset.
Wet ditches, edge of wet woods. ELM: common; NWE: common.
46. *Eupatorium purpureum* L. Joe-Pye-weed.
Wet ditch along railroad, wet prairie. ELM: common; NWE: scarce, No. 44 is much more common.

47. *Gnaphalium obtusifolium* L. var. *obtusifolium*. Cudweed.
Dry sandy fields. ELM: common, as *Gnaphalium polycephalum* Michx.; NWE: common.
48. *Gnaphalium purpureum* L. Purplish Cudweed.
ELM: one specimen from wet prairie, (Moseley 958, Bowling Green State University Herbarium); NWE: no specimens collected.
49. *Gnaphalium uliginosum* L. Marsh Cudweed.
ELM: one specimen from garden at Cook School, Oak Openings, (Moseley 954, Bowling Green State University Herbarium); NWE: no specimens collected.
50. *Grindelia squarrosa* (Pursh) Dunal Gum-plant.
ELM: rare, no specimens available for study; NWE: no specimens collected.
51. *Helenium autumnale* L. Sneezeweed.
Floodplain. ELM: rare; NWE: frequent.
52. *Helianthus divaricatus* L. var. *divaricatus*.
Dry sandy fields, dunes. ELM: abundant; NWE: abundant.
53. *Helianthus doronicoides* Lam. Oblong-leaved Sunflower.
ELM: listed as rare, but no specimens available for study; NWE: no specimens collected. Heiser (1969) lists this taxon as a hybrid.
54. *Helianthus giganteus* L. Giant Sunflower.
Moist woods. ELM: abundant; NWE: abundant.
55. *Helianthus grosseserratus* Martens. Sawtooth Sunflower.
Edge of moist woods. ELM: rare; NWE: rare.
- *56. *Helianthus occidentalis* Riddell. Few-leaved Sunflower.
Dry sandy fields, dunes. ELM: frequent; NWE: abundant.
57. *Helianthus strumosus* L. Paleleaf Wood Sunflower.
Roadside ditch near Swan Creek, Rte. 295. ELM: not listed; NWE: infrequent.
58. *Helianthus tuberosus* L. Jerusalem Artichoke.
Floodplain, roadside ditch. ELM: rare; NWE: rare.
59. *Heliopsis helianthoides* (L.) Sweet ssp. *helianthoides* Fisher comb. nov. Ox-eye.
Floodplain. ELM: listed with no comment; NWE: frequent.
60. *Heliopsis helianthoides* (L.) Sweet ssp. *occidentalis* Fisher ssp. nov.
Floodplain, wet ditches. ELM: not listed; NWE: infrequent, listed as var. *scabra* (Dunal.) Fern., edition 8, Gray's Manual (see Fisher, 1957).
61. *Hieracium canadense* Michx. var. *fasciculatum* (Pursh) Fern.
Dry roadsides. ELM: infrequent; NWE: rare, one specimen, Reed Road dump site.
- *62. *Hieracium gronovii* L. Hawkweed.
Moist sands, edge of wet woods near dunes. ELM: frequent; NWE: frequent along Davis Road.
63. *Hieracium scabrum* Michx.
Two voucher specimens available for study, Schultz, 1897, Ohio State University Herbarium, Moseley No. 1036, Bowling Green State University Herbarium; NWE: no specimens collected.
64. *Krigia biflora* (Walt.) Blake Dwarf Dandelion.
Moist ditches. ELM: common, as *Krigia amplexicaulis* Nutt.; NWE: common.
Late spring.
65. *Krigia virginica* (L.) Willd. Dwarf Dandelion.
Dunes. ELM: not listed; NWE: frequent in sand along Davis Road. Spring, early summer.
66. *Lactuca biennis* (Moench.) Fern.
Wet ditches, edge of wet woods. ELM: not listed; NWE: infrequent along Davis Road.
67. *Lactuca canadensis* L. var. *canadensis*.
Moist open woods. ELM: not listed; NWE: rare, one specimen from Wilkins Road.
68. *Lactuca canadensis* L. var. *latifolia* Ktze.
Edge of moist woods. ELM: not listed; NWE: rare, one specimen from Davis Road.
69. *Lactuca canadensis* L. var. *longifolia* (Michx.) Farw.
Roadsides, railroad embankments. ELM: frequent; NWE: frequent.
70. *Lactuca floridana* (L.) Gaertn. Blue Lettuce.
ELM: two specimens from Toledo area, no information, Moseley 1061, 1066, Bowling Green State University Herbarium; NWE: no specimens collected.
71. *Lactuca pulchella* (Pursh.) DC. Blue Lettuce.
ELM: one specimen from Oak Openings, Van Gundy No. 1062, Bowling Green State University Herbarium; NWE: no specimens collected.
72. *Lactuca scariola* L. Prickly Lettuce.
Railroad ditch, floodplain. ELM: common; NWE: infrequent.
- *73. *Liatriis aspera* Michx. var. *aspera*.
Dry sandy fields, roadsides. ELM: common, as *Liatriis scariosa* Willd., which is listed as a montane species in edition 8, Gray's Manual; NWE: common.

74. *Liatris spicata* (L.) Willd. var. *spicata*.
Wet prairie, wet ditches. ELM: frequent; NWE: frequent in Irwin Prairie, infrequent in other places.
- *75. *Liatris squarrosa* (L.) Michx. Scaly Blazing-star.
In sand near wet woods. ELM: frequent; NWE: frequent along Davis Road.
76. *Prenanthes altissima* L. Tall Rattlesnake-root.
Moist woods. ELM: frequent; NWE: frequent in Maumee State Forest.
- *77. *Prenanthes racemosa* Michx. Glaucous Rattlesnake-root.
Wet prairie, wet ditches and woods, especially along Davis Road. ELM: frequent; NWE: frequent.
78. *Ratibida pinnata* (Vent.) Barnh. Prairie Cone-flower.
Railroad ditches, floodplain. ELM: listed with no comment, as *Lepachys pinnata* (Vent.) T. & G.; NWE: infrequent.
79. *Rudbeckia laciniata* L. Tall Cone-flower.
Floodplain. ELM: not listed; NWE: infrequent.
80. *Rudbeckia serotina* Nutt. var. *serotina*. Black-eyed Susan.
Roadsides, dry sandy fields. ELM: common, as *Rudbeckia hirta* sensu most authors, not L.; NWE: common.
81. *Rudbeckia triloba* L. var. *triloba*.
Moist woods and ditches near Swan Creek. ELM: not listed; NWE: infrequent.
82. *Senecio aureus* L. var. *gracilis* (Pursh.) Wood. Spring.
Wet woods. ELM: listed with no comment; NWE: frequent.
83. *Senecio vulgaris* L. Common Groundsel.
Naturalized from Europe, a garden weed. ELM: not listed; NWE: rare, along Wabash Railroad.
84. *Senecio pauperculus* Michx. var. *balsamitae* (Muhl.) Fern.
ELM: listed with no comment, as *Senecio balsamitae* Muhl., no specimens available for study; NWE: no specimens collected.
85. *Silphium perfoliatum* L. Indian-cup.
Floodplain. ELM: not listed; NWE: one specimen collected by Glen Firebaugh, Toledo Naturalist Association.
86. *Silphium terebinthinaceum* Jacq. Prairie Dock.
Wet ditches along Wabash Railroad. ELM: scarce; NWE: scarce.
87. *Silphium trifoliatum* L.
ELM: rare, no comment, no specimens available for study; NWE: no specimens collected.
88. *Solidago altissima* L. Tall Goldenrod.
Wet prairie, wet woods, ditches. ELM: not listed; NWE: frequent.
89. *Solidago canadensis* var. *canadensis*. Canada Goldenrod.
Roadsides, railroad embankment, dry fields. ELM: common; NWE: common.
90. *Solidago canadensis* L. var. *gilvocanescens* Rydb.
Roadsides, railroad embankment. ELM: not listed; NWE: infrequent.
91. *Solidago gigantea* Ait. var. *leiophylla* Fern.
Moist woods, floodplain. ELM: rare, as *Solidago serotina* Ait. var. *gigantea* (Ait.) Gray; NWE: frequent.
92. *Solidago graminifolia* (L.) Salisb. var. *nuttallii* (Greene) Fern.
Dry fields, moist sand, wet prairie. ELM: abundant; NWE: abundant.
93. *Solidago hispida* Muhl. var. *hispida*.
Moist sand. ELM: not listed, but two specimens collected, Moseley No. 1198, 1936 and Moseley No. 1170, 1924; NWE: infrequent.
94. *Solidago juncea* Ait.
Railroad embankment, dry fields, edge of dry woods. ELM: common; NWE: common.
95. *Solidago nemoralis* Ait.
Dry fields, dunes. ELM: abundant, NWE: abundant.
96. *Solidago patula* Muhl. Roundleaf Goldenrod.
A swamp species. ELM: common, but no specimens available for study; NWE: no specimens collected.
- *97. *Solidago remota* (Greene) Friesner.
Wet prairie, wet ditches, railroad embankment. ELM: frequent, as *Solidago moseleyi* Fern.; NWE: frequent.
98. *Solidago riddellii* Frank.
Wet prairie. ELM: rare, NWE: frequent in Irwin Prairie.
99. *Solidago rigida* L.
ELM: infrequent in Oak Openings, but common eastward near Toledo; NWE: no specimens collected. Two specimens from Toledo area, Burglehaus, 1900 (Ohio State University Herbarium) available for study.
100. *Solidago rugosa* Ait. var. *aspera* (Ait.) Fern.
Dry sandy fields, roadsides, edge of dry woods. ELM: no variety listed; NWE: common.

101. *Solidago rugosa* Ait. var. *rugosa*.
Moist woods, moist sand near dunes. ELM: abundant; NWE: abundant.
102. *Solidago speciosa* Nutt. var. *angustata* T. & G.
Dry fields, edge of dry woods. ELM: common; NWE: infrequent. Specimens collected by Jeanne Hawkins, Toledo Naturalist Association.
103. *Solidago uliginosa* Nutt. Bog Goldenrod.
A swamp species. ELM: cites one specimen collected in 1897, but specimen not available for study; NWE: no specimens collected.
104. *Solidago ulmifolia* Muhl. Elm-leaved Goldenrod.
Moist woods. ELM: common; NWE: common.
105. *Sonchus arvensis* L. Field Sow-thistle.
Naturalized from Europe. ELM: not listed; NWE: no specimens collected. One specimen from Ohio State University Herbarium, R. B. Gordon, 1927; and one specimen in Bowling Green State University Herbarium, Moseley, No. 1302 available for study.
106. *Sonchus asper* (L.) Hill. Spiny-leaved Sow-thistle.
Naturalized from Europe. ELM: not listed; NWE: no specimens collected. One specimen from Toledo area, Burtlehaus, 1901, Ohio State University Herbarium.
107. *Sonchus oleraceus* L. Common Sow-thistle.
Naturalized from Europe. ELM: not listed; NWE: no specimens collected. One specimen collected by Moseley in 1930, Bowling Green State University Herbarium.
108. *Sonchus uliginosus* Bieb.
Naturalized from Europe. ELM: not listed; NWE: no specimens collected. One specimen from Rte. 64, Whitehouse, Ohio, Primmer No. 2297, Ohio State University Herbarium.
109. *Taraxacum officinale* Weber. Dandelion.
Naturalized from Europe. Grassy roadsides. ELM: frequent; NWE: frequent.
110. *Veronia altissima* Nutt. Tall Ironweed.
Wet ditches, especially along railroad, edge of moist woods. ELM: frequent; NWE: frequent.
- *111. *Veronia missurica* Raf.
Wet ditches along railroad, edge of wet woods. ELM: frequent, including *Vernonia illinoensis* Gleason; NWE: frequent.
112. *Xanthium pennsylvanicum* Wallr. Cockle-bur.
Edge of moist woods, edge of pond. ELM: rare, as *Xanthium canadense* Mill.; NWE: local at pond side along Davis Road, elsewhere infrequent.
113. *Xanthium strumarium* L.
Adventive from Europe. Floodplain. ELM: not listed; NWE: rare, one specimen for Swan Creek floodplain.

DISCUSSION

The changes that are apparent from the notations in the check list of this second "Flora of the Oak Openings," in addition to nomenclatural changes, are (1) species that were observed or reported by Moseley (1928), but not by this investigator; (2) species that were observed or reported by this investigator, but not by Moseley; and (3) significant changes in the frequency of occurrence of some species since publication of Moseley's study. In addition, some problems exist in the interpretation of Moseley's citations of some species.

The following species, or varieties, were reported by Moseley (1928), but were not found in the present investigation.

- Ambrosia trifida* L.
Arctium minus (Hill.) Bernh.
Artemisia vulgaris L.
Bidens connata Muhl.
Chrysanthemum leucanthemum L.
Eclipta alba (L.) Hassk.
Erigeron pulchellus Michx.
Gnaphalium purpureum L.
Gnaphalium uliginosum L.
Grindelia squarrosa (Pursh) Dunal.
Helianthus doronicoides Lam. (now, *H. x doronicoides*) (Heiser, 1969)
Hieracium scabrum Michx.

Lactuca floridana (L.) Gaertn.
Lactuca pulchella (Pursh) DC.
Senecio pauperculus Michx. var. *balsamitae* (Muhl.) Fern.
Silphium trifoliatum L.
Solidago patula Muhl.
Solidago rigida L.
Solidago uliginosa Nutt.

Reasons for these local extinctions are not definitely known, and are probably different for different species. Many must have grown in marshes or very wet places and have been eliminated when drainage ditches were dug. Some species were undoubtedly destroyed during early clearing of the land and other man-made disturbance in roadside habitats, cultivated fields, and residential sites. Other species are probably either adventive or those that do not live long in sandy habitats; such species were probably not common at the time of Moseley's work and have since disappeared. In addition, northwest Ohio may represent the margin of the distributional range of some of the species, species which do not now happen to be present in the Oak Openings, though they are reported by Moseley (1928).

The following plants were reported in this investigation, but were not reported by Moseley (1928). A number of these are varieties or subspecies. Moseley cited very few varieties, and the subspecies of *Heliopsis helianthoides* (L.) Sweet were separated by Fisher in 1957.

Aster cordifolius L.
Eupatorium altissimum L.
Helianthus strumosus L.
Heliopsis helianthoides (L.) Sweet ssp. *occidentalis* Fisher ssp. nov.
Krigia virginica (L.) Willd.
Lactuca biennis (Moench.) Fern.
Lactuca canadensis L. var. *canadensis*
Lactuca canadensis L. var. *latifolia* Ktze.
Rudbeckia laciniata L.
Rudbeckia triloba L. var. *triloba*.
Senecio vulgaris L.
Silphium perfoliatum L.
Solidago altissima L.
Solidago canadensis L. var. *gilvocanescens* Rydb.
Solidago rugosa Ait. var. *aspera* (Ait.) Fern.
Sonchus arvensis L.
Sonchus oleraceus L.
Sonchus uliginosus Bieb.
Xanthium strumarium L.

The reason for the existence of the varieties and subspecies in this list is obvious. Why the other species are also here is less clear. A number of these represent European introductions, which had apparently not reached northwest Ohio until after the time of Moseley's work. Certainly some are adventive species, which have appeared only recently and which may or may not persist here. In addition, several of the species were found on the floodplain of Swan Creek.

There are a number of species which have been reported from both surveys, but whose frequency of occurrence has changed since the time of Moseley (1928). These are listed below in two categories, those whose frequency has decreased since Moseley's work, and those whose frequency has increased. Explanations for the decreased frequencies are probably the same as for those species listed earlier which were reported by Moseley (1928), but not observed in the present

investigation. Similarly, explanations for the increased frequencies of other species are probably the same as for those species listed above which were reported only in this study.

DECREASED FREQUENCY

<i>Antennaria plantaginifolia</i> (L.) Hook.	ELM: common; NWE: infrequent.
<i>Aster novae-angliae</i> L.	ELM: common; NWE: frequent.
<i>Aster pilosus</i> Willd. var.	
<i>platyphyllus</i> (T. & G.) Blake	ELM: frequent; NWE: infrequent.
<i>Bidens cernua</i> L.	ELM: frequent; NWE: local.
<i>Bidens comosa</i> (Gray) Wieg.	ELM: common; NWE: infrequent.
<i>Cichorium intybus</i> L.	ELM: scarce; NWE: rare.
<i>Cirsium arvense</i> (L.) Scop.	ELM: frequent; NWE: rare.
<i>Erechtites hieracifolia</i> (L.) Pers.	ELM: common; NWE: infrequent.
<i>Eupatorium purpureum</i> L.	ELM: common; NWE: scarce.
<i>Hieracium canadense</i> Michx.	ELM: infrequent; NWE: rare.
<i>Lactuca scariola</i> L.	ELM: common; NWE: infrequent.
<i>Solidago speciosa</i> Nutt. var.	
<i>angustata</i> T. & G.	ELM: common; NWE: infrequent.

INCREASED FREQUENCY

<i>Aster pilosus</i> Willd. var. <i>pilosus</i>	ELM: frequent; NWE: common.
<i>Aster sagittifolius</i> Weden	ELM: infrequent; NWE: frequent.
<i>Bidens coronata</i> (L.) Britt. var.	
<i>tenuiloba</i> (Gray) Sherff.	ELM: local; NWE: frequent.
<i>Helenium autumnale</i> L.	ELM: rare; NWE: frequent.
<i>Helianthus occidentalis</i> Riddell.	ELM: frequent; NWE: abundant.
<i>Solidago gigantea</i> Ait. var.	
<i>leiophylla</i> Fern.	ELM: rare; NWE: frequent.
<i>Solidago riddellii</i> Frank.	ELM: rare; NWE: frequent.
<i>Xanthium pensylvanicum</i> Wallr.	ELM: rare; NWE: infrequent.

One major problem in the interpretation of Moseley's work is the lack of voucher specimens for some citations. Some of the plants may have been collected, the specimens having since been lost, but in many cases, they appear never to have been collected. In addition, some damage may have occurred in campus store rooms during the past four decades (all voucher specimens are now stored in steel herbarium cases). The lack of habitat data also presents a problem of knowing where Moseley collected some of the plants.

Moseley prepared a list of those species that were more common in the Oak Openings than in all the remainder of Ohio. This list follows:

Aster azureus Lindl.
Aster praeltus Poir.
Aster vimineus Lam.
Helianthus occidentalis Riddell
Hieracium gronovii L.
Liatris aspera Michx.
Liatris squarrosa (L.) Michx.
Prenanthes racemosa Michx.
Solidago remota (Greene) Friesner
Vernonia missurica Raf.

An asterisk has been placed before each of these species in the annotated list. Only three of these species do not now occur in such abundance: (1) *Aster junci-formis* Rybd. (Moseley's specimens of which key out to *Aster vimineus* Lam.);

(2) *Senecio pauperculus* Michx. var. *balsamitae* (Muhl.) Fern. (of which, though Moseley cited it, no voucher specimens are available, and no specimens have been collected during the present study); and (3) *Solidago speciosa* Nutt. var. *angustata* T. & G. (which has decreased in numbers since Moseley's time).

SUMMARY

Of the 113 taxa annotated in this study, 87 were reported by Moseley (1928), and 88 taxa have been found by this investigator up to the present time (1970). Nineteen taxa reported by Moseley (1928) have not been found during the present investigation, of which 13 lack voucher specimens as supportive evidence. Most of these species are presumed to have been eliminated by man-made disturbance such as drainage, road construction and maintenance, crop cultivation, and residential development. Twenty taxa were collected during this study that were not reported by Moseley in 1928, species which are believed to represent adventive species or European introductions, or varieties or subspecies not cited by or not known to Moseley. Eight taxa are more numerous now (1970) than they were in Moseley's time (1928), and twelve taxa are less frequent now than in Moseley's time, frequency changes for which the above sets of explanations also probably apply. Of Moseley's list of species most characteristic of Oak Openings habitats, three taxa no longer appear to fit: *Aster junciformis* Rydb., which appears to have been incorrectly identified; *Senecio pauperculus* Michx. var. *balsamitae* (Muhl.) Fern., for which no voucher specimens are available; and *Solidago speciosa* Nutt. var. *angustata* T. & G., which is now less common than in the days of Moseley's work.

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