

## BOREAL PLANT RELICS IN INDIANA

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"It is not known positively that either of the first two recognized ice advances of the Pleistocene period came into the Indiana region. Both the Nebraskan and Kansas ice sheets locally advanced much further south than the latitude of northern Indiana, and it is quite likely that one or both of these earlier ice sheets advanced far enough south to enter the Indiana region".<sup>1</sup> The boundaries of the Illinois and Wisconsin glaciers have been carefully located<sup>1</sup> by geologists of the state (Fig. 1).

On the basis of glaciation, Indiana is divided into two divisions: the glaciated and the unglaciated (Fig. 1). The glaciated area is largely a plain of glacial construction and the unglaciated portion shows the results of long subjection to weathering agencies and running water. Approximately 30,100 square miles (five-sixths of the state) were glaciated and about 6,250 square miles (a sixth) were untouched by the ice. There are two distinct divisions of the glaciated portion (Fig. 1). The northern fourth of the state, known as the Northern Moraine and Lake Region, is characterized by numerous moraine lakes and by lacustrine plains. The remainder of the glaciated area, approximately 11,900 square miles (nearly a third of the area of the entire state), is recognized as the Tipton till plain, which is chiefly characterized by a covering of glacial till of nearly level surface without lakes and not well dissected by streams. This till plain is subdivided into two sections, the Illinoian, which is the older and more southern, and the Wisconsin, the younger and more northern. Although there are no lakes in the Tipton till plain, marshes and swamps were formerly common but have since been drained artificially. This plain is the highly productive area of the state.

Thus, in a general way, the physiography of Indiana and the possible habitats of the plants are presented. There are at least four factors which have greatly changed these natural habitats, and, which, as a result, have influenced more or less the flora of the area. These factors are acidity and alkalinity of soil, drainage, agriculture, and grazing. The acidity and alkalinity of the soil are probably two major factors in bringing about the discontinuous distribution of some boreal relics in Indiana. Plants which have a wide range of pH tolerance are found throughout the state, and those which require acid or alkaline habitats are restricted to these respective areas. Thus, it is logical to assume that at the close of the glacial period many plants may have been left in unfavorable habitats with regard to ecological factors and failed to survive, leaving a few scattered, more fortunate members of the species to survive as relics of the ice age and to continue the species through the thousands of succeeding years. Doubtlessly the drainage of many bogs and swamps has ruined the habitats of other relic species, causing a decrease in the number of plants of the surviving species if not the extinction of the species in our area. The cultivation of large areas of the state for the various crops probably has caused a reduction in num-

<sup>1</sup>Malott, C. A. 1922. The physiography of Indiana. Handbook of Indiana geology, pp. 141-152.

bers and in frequency of many of the relic species. It seems that this explanation would be applicable especially to the Tipton till plain. The results of grazing are evident without discussion.

There are approximately 300 species<sup>2</sup> of plants of a northern range within the longitude of Indiana that reach the southern limit of their distribution in Indiana. Boreal plants in North America are those which have a mass distribution in the northern portion of the continent at the present time. Boreal relics in Indiana are considered to be boreal plants which have a discontinuous distribution in our area and occur in increasing numbers northward. This paper deals with plants, within the longitude of Indiana,<sup>3</sup> whose mass distribution is north of Indiana and whose southern limit within this longitude is not south of the glaciated area, except in a portion which has the possibility of having been directly influenced by the glacier. Those plants which do grow in continuous similar habitats are said to have discontinuous or interrupted distribution. Specimens of relic species are usually few in number in each locality of occurrence. Some of the boreal species which gradually migrated southward during the Pleistocene times found favorable spots in Indiana. Here they have remained since the retreat of the glaciers and have survived the competition of other plants. These surviving plants are peculiar to certain restricted habitats. There are at least three possible explanations of the presence of boreal relic plants in Indiana. Firstly, the plants were brought southward by the glacier. Those in the most favorable habitats survived when the ice melted. Thus northern species were introduced into Indiana. The advancement of the boreal plants from the north in front of the ice and the gradual return, by survival in favorable situations and death in unfavorable locations, of the boreal species from the south toward the north, with the increase in temperature upon the retreat of the glacier, is considered by the author as vertical migration of the boreal plants. Secondly, boreal plants might have survived the ice period in the Appalachian region and migrated westward into Indiana since the ice age. Or, thirdly, the species might have been boreal relics in states west or northwest of Indiana and migrated eastward into the state since the retreat of the glacier. The last two methods illustrate a type of introduction of boreal species which may be regarded as lateral or horizontal post-glacial migration.

The county distribution and the habitats of these boreal relics in Indiana are based largely upon the data obtained from the specimens in the Deam Herbarium, Bluffton, Indiana. The accompanying maps show the distribution of each species in relation to the physiographic divisions of the state.<sup>4</sup> For ready reference the species and genera have been arranged alphabetically in the enumeration and in the illustrations. The list includes twenty-two species.

<sup>2</sup>Deam, C. C. 1925. Flora of Indiana; on the distribution of the ferns, fern allies and flowering plants. Proc. Ind. Acad. Sci. 34:39-53.

<sup>3</sup>Longitude 86° and latitude 40° cross near the geographic center of the state.

<sup>4</sup>The distribution of many of these species in counties of neighboring states aids in determining the boreal relic plants in Indiana. See: Schaffner, John H., 1914. Catalog of Ohio vascular plants. Ohio Biol. Surv. Bull. 2, 1:127-247; Transeau, E. N. & Williams, P. E., 1929. Distribution maps of certain plants in Ohio. Ohio Biol. Surv. Bull. 20, 4:181-217.

## Indiana boreal relic plants and their distribution by counties

*Carex eburnea* Boott. Dry sandy or rocky soil, preferring limestone. E. Que. and N. B. to Mackenzie and Alb., s. locally to Va., Ohio, Ky., Ind., Mo., and Neb. Indiana Dist.—Lake, Jefferson counties.

*Carex projecta* Mack. Damp soil. Gulf of St. Lawrence and N. S. to Ont. and N. Dak., s. to N. Y., Conn., D. C., Ind., Ill., and Ia. Ind. Dist.—Hendricks, Marion.

*Circaea alpina* L. Bogs and moist woods. Lab. to Alaska, s. to Ga., Ohio, Ind., Mich., n. e. Ia., and S. Dak. Ind. Dist.—Porter, Laporte, Lagrange, Steuben, Allen, Montgomery.

*Cornus rugosa* Lam. Wooded bluffs, sandy, rocky situations. E. Que. and N. S. to Man., s. to Va., Ohio, Ind., Ill., Ia., and N. Dak. Ind. Dist.—Lake, Porter, Laporte, St. Joseph, Lagrange, Montgomery.

*Cypripedium reginae* Ait. Swamps, bogs, woods. Nfd. to Ont., Ga., Ind., Wis., Minn., and Mo. Ind. Dist.—Lake, Laporte, Lagrange, Steuben, Cass, Tippecanoe, Montgomery, Henry.

*Diervilla lonicera* Mill. Dry or rocky wooded ridges or slopes. Nfd. to Man., s. to N. C., Ohio, Ind., and Wis. Ind. Dist.—Lake, Porter, Laporte, Starke, Jasper, Fountain.

*Eleocharis intermedia* (Muhl.) Schultes. Marshes, springy boggy places. Que. to Ont., s. w. to N. J., Pa., Ohio, Ind., Ill., and Ia. Ind. Dist.—Laporte, Noble, Marshall, Starke, Steuben, Whitley, Knox.

*Gentiana procera* Holm. Wet places. Ont. to Man., s. to N. Y., Ind., Ia., Minn., and S. Dak. Ind. Dist.—Lagrange, St. Joseph, Steuben, Fulton, Madison, Tippecanoe.

*Habenaria orbiculata* (Pursh) Torr. Rich woods. Lab. and Nfd. to Alaska and B. C., s. to N. C., Ohio, Ind., Minn., and Wash. Ind. Dist.—Marshall, Wells.

*Hydrocotyle americana* L. Wet places. N. S. to Ont. and Minn., s. to southern N. Y., Pa., and in the mts. to N. C. Ind. Dist.—Lagrange, Jefferson.

*Juniperus communis* L., var. *depressa* Pursh. Sand dunes, weathered rocky slopes. Nfd. to southern New England and the shores of the Great Lakes. Ind. Dist.—Lake, Porter, Laporte, Elkhart, Steuben, Wayne, Jefferson.

*Maianthemum canadense* Desf. Moist woods. Lab. and Nfd. to Mackenzie and Man., s. to N. C., Tenn., Ohio, Ind., Ia., and S. Dak. Ind. Dist.—Laporte, St. Joseph, Elkhart, Steuben, DeKalb, Noble, Kosciusko, Marshall, Jefferson. Although Jefferson County is in the glaciated area, it is possible that this species is not a boreal relic but has entered this particular locality from Ohio where it is reported as having a general distribution.<sup>5</sup>

*Panax trifolium* L. In moist woods and thickets. N. S. to W. Ont., s. to Del., Md., Ill., Ia., and along the mts. to Ga. Ind. Dist.—Lake, Porter, St. Joseph, Elkhart, Steuben, DeKalb, Noble, Kosciusko, Marshall, Carroll, Decatur, Jennings.

<sup>5</sup>Schaffner, John H. 1914. Catalog of Ohio vascular plants. Ohio Biol. Surv. Bull. 2, 1:127-247.

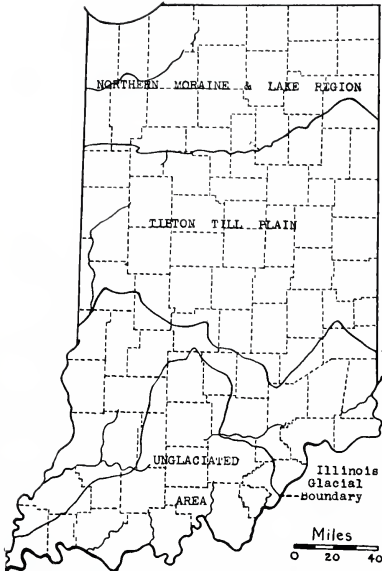


Fig. 1. Regional units of Indiana based on glaciation

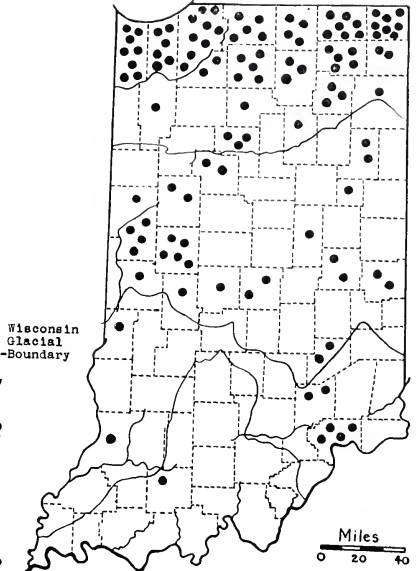


Fig. 2. Distribution of boreal relic species in Indiana according to counties.



Figs. 1-4.

*Pinus Strobus* L. Sand dunes, marshy places, sandstone outcrops. Nfd. to Man., s. along the mts. to Ga., w. to Ind., Ill., and e. Ia. Ind. Dist.—Lake, Porter, Laporte, St. Joseph, Warren, Fountain, Montgomery.

*Poa paludigena* Fernald and Wiegand. Wet places. N. Y., Pa., Mich., Ill., Ind. Ind. Dist.—Lagrange, Dubois. Although only the northwestern portion of Dubois county was glaciated, there was, according to geologists, a lake extending several miles beyond the ice. Probably this species illustrates the persistence of a plant beyond the glacier. (It was collected in Dillon Swamp, about 4 miles north of Jasper.)

*Potentilla fruticosa* L. In swamps or moist rocky places. Greenland and Lab. to Alaska, s. to N. J., Pa., Ohio, Ind., Ill., n. Ia., Minn., in the Rocky Mts. to Ariz., and in the Sierra Nevada to Cal. Ind. Dist.—Lake, Laporte, Lagrange, Steuben, Noble, Kosciusko, Marshall, Whitley, Wabash, Cass, Henry, Wayne, Decatur.

*Prunus nigra* Ait. Low woods. N. B. to Assin., s. to N. Y., Ohio, Ind., Wis. Ind. Dist.—Elkhart, Wells, Blackford, Marion.

*Sanguisorba canadensis* L. Swamps and low meadows. Lab. and Nfd., s. to mts. of Ga. and w. to Ohio, Ind., and Mich., and on west coast, B. C. to Alaska. Ind. Dist.—Fountain, Vigo.

*Schizachne purpurascens* (Torr.) Swallen. Rocky wooded slopes. Lab. to Alaska, s. to Pa., Ind., S. Dak., and in mts. to N. Mex. Ind. Dist.—Cass.

*Spiranthes lucida* (H. H. Eaton) Ames. Moist banks and woods. N. S. to Ont. and Minn., s. to Va., Pa., Ohio, Ind., and Wis. Ind. Dist.—Noble, Whitley, Carroll, Jennings.

*Taxus canadensis* Marsh. Woods, near upper edge of canyons. Nfd. to Man., s. to N. J., in Alleghenies to Va., Ohio, Ind., Ia., and Minn. Ind. Dist.—Montgomery, Parke, Putnam.

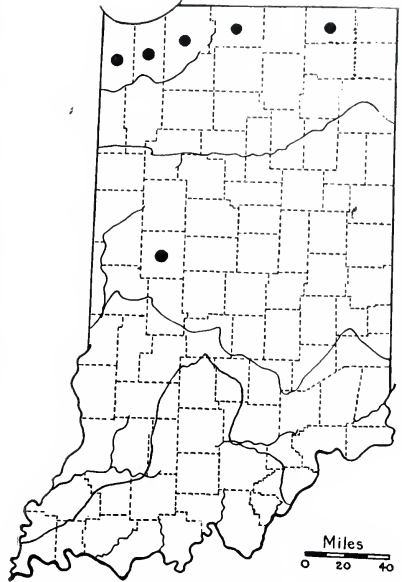
*Vaccinium canadense* Kalm. Rocky wooded slopes. Lab. to Man., s. in mts. to Va., Pa., Ohio, Ind., Ill., and Mich. Ind. Dist.—Fountain.

As is shown in Fig. 2, there is a gradual reduction in the number of boreal relic species from the northern portion of the state to the southern; the number of boreal relic species in the Wisconsin portion of the Tipton till plain is approximately three times that in the Illinoian; and the number of boreal relic species in Montgomery county is larger than in any other county in the Tipton till plain, with Fountain County ranking second in this respect.

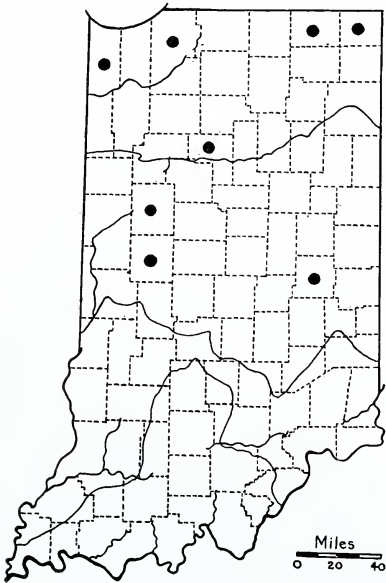
Because of the lack of definite information concerning the distribution in Michigan of the boreal species occurring in the Northern Moraine and Lake Region of Indiana, it is impossible to decide whether or not these species are relics. The names of several of these boreal plants follow, although no attempt has been made to exhaust the list: *Andromeda glaucophylla*, *Calla palustris*, *Carex Bebbii*, *Chamaedaphne calyculata*, *Clintonia borealis*, *Coptis trifolia*, *Corydalis sempervirens*, *Eleocharis pauciflora*, *Eriophorum callitrix*, *Habenaria hyperborea*, *Larix laricina*, *Linnaea borealis*, *Myosotis laxa*, *Myrica asplenifolia*, *Nemophanthus mucronata*, *Pinus Banksiana*, *Polygala pauciflora*, *Thuja occidentalis*, and *Trientalis americana*.



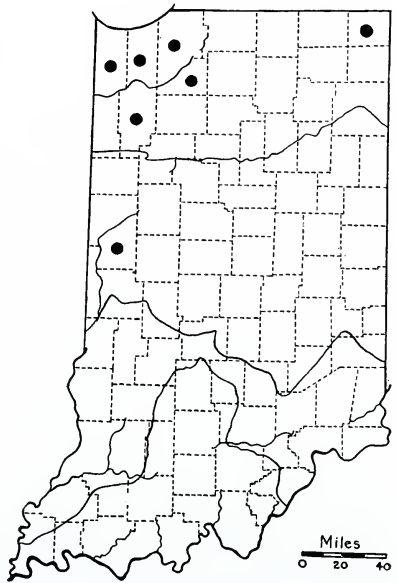
*Circaea alpina*



*Cornus rugosa*



*Cypridium reginae*

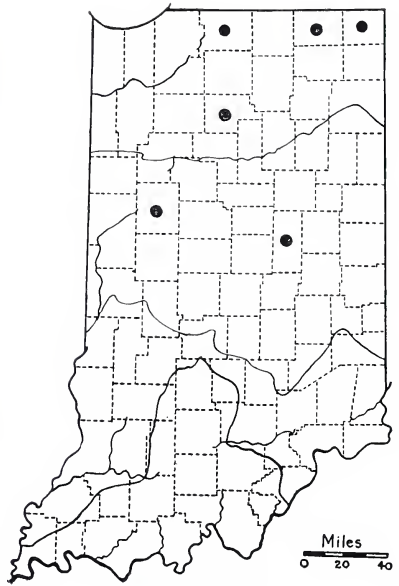


*Diervilla Lonicera*

Figs. 5-8.



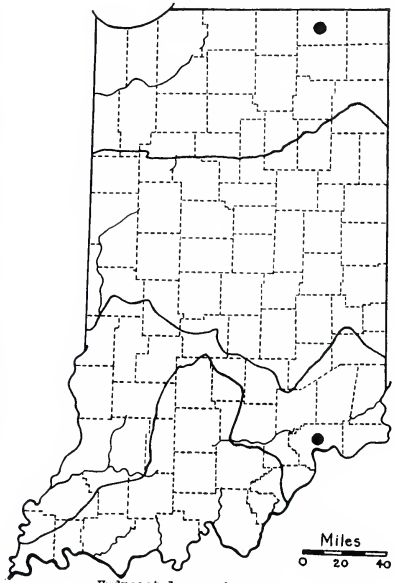
*Eleocharis intermedia*



*Gentiana procera*

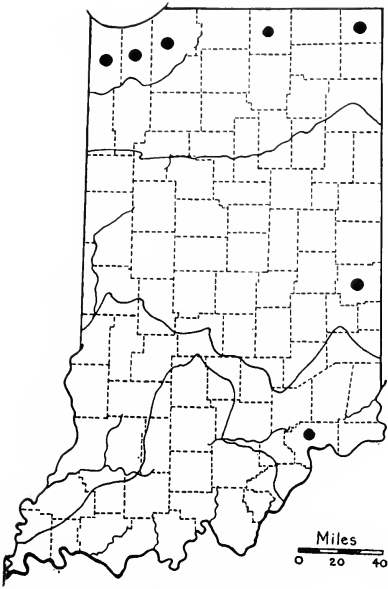


*Habenaria orbiculata*

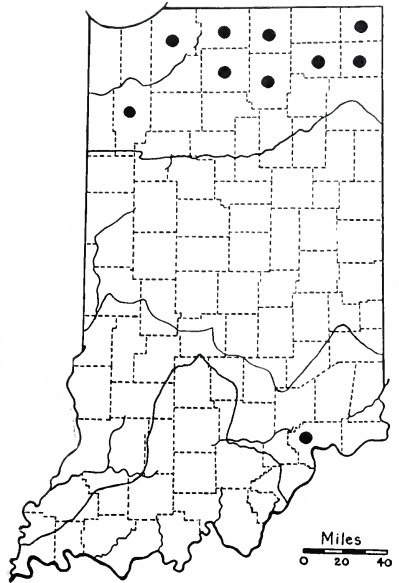


*Hydrocotyle americana*

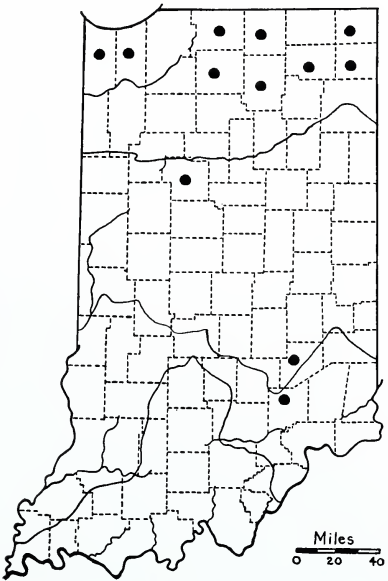
Figs. 9-12.



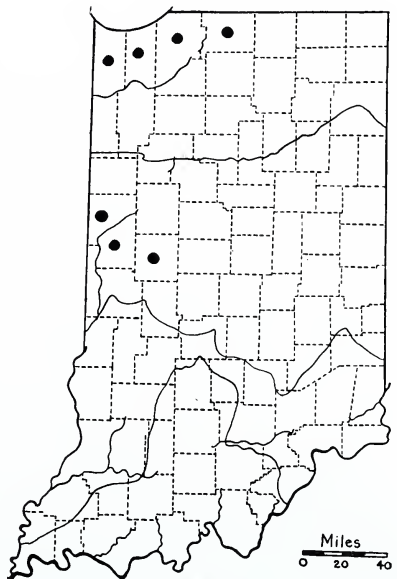
*Juniperus communis depressa*



*Maianthemum canadense*



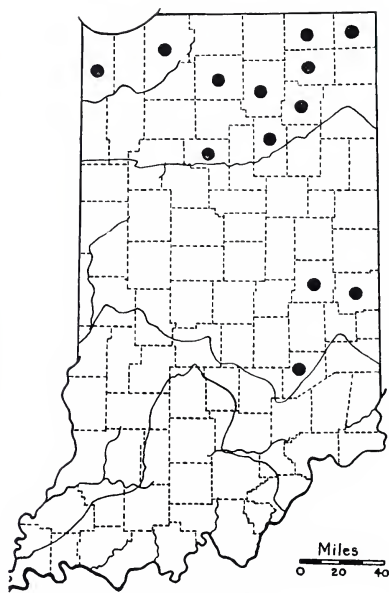
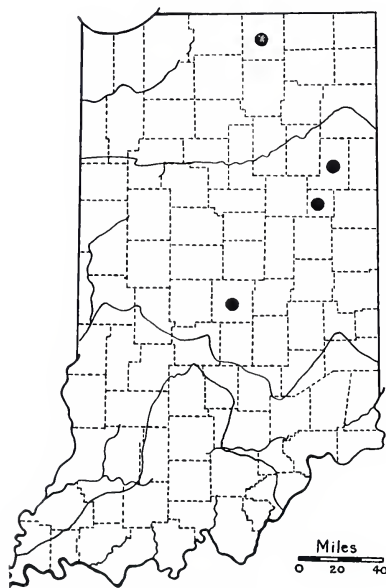
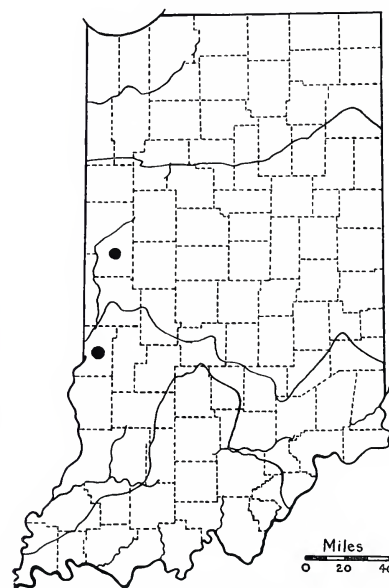
*Panax trifolium*

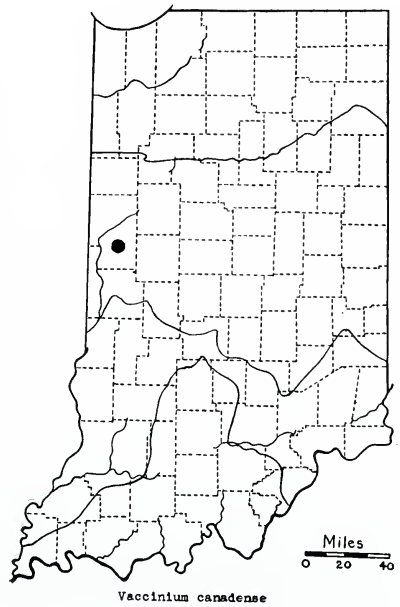
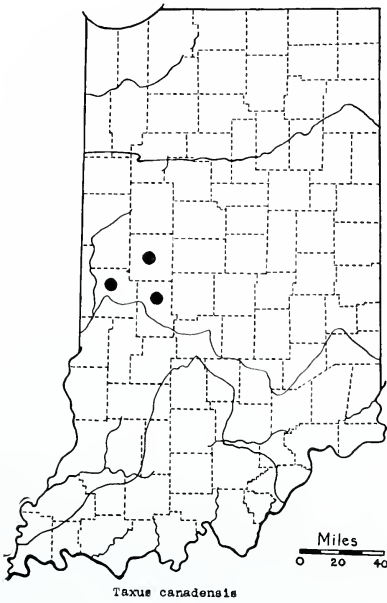
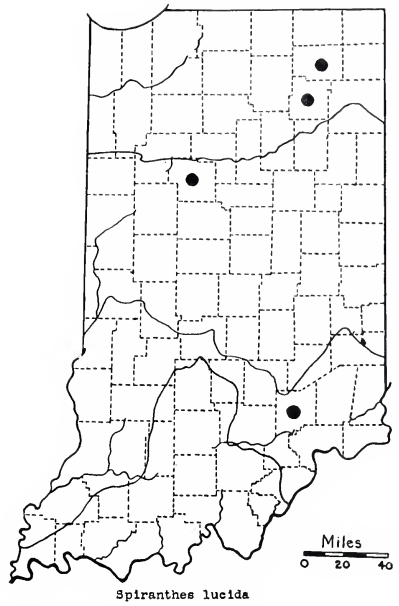


*Pinus Strobus*

Figs. 13-16.



*Poa paludigena**Potentilla fruticosa**Fraxinus nigra**Sanguisorba canadensis*



Figs. 21-24.

Several species of plants that are members of the flora of the Allegheny plateau and the Appalachian mountains are found in Indiana. Although the list may be incomplete, the following species are noteworthy: *Castanea dentata*, *Hydrangea arborescens*, *Kalmia latifolia*, *Pinus virginiana*, *Rubus odoratus*, *Quercus Prinus*, and *Tsuga canadensis*.

Because *Betula lutea* is found in several counties in the Northern Moraine and Lake Region it seems that it belongs with the group of boreal plants which may or may not be relic species. Since it is difficult to understand how the presence of this species in Crawford County can be due to the glacier, perhaps it is more satisfactory to classify the yellow birch in southern Indiana with the plants that have their origin in the flora of the eastern mountains.

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