

and also to give him an idea of how much and what mineral constituents he must apply from year to year to meet the demands of a thrifty tree.

The writer is indebted to Prof. G. C. Caldwell, of Cornell University, for the material and assistance that enabled him to carry on this investigation

POISONOUS EFFECTS OF *CYPRIPEDIUM SPECTABILE*. By D. T. McDOUGAL. Published in the Minnesota Botanical Studies, Part I; 32-36.

SYMBIOSIS OF *ISOPYRUM BITERNUM*. By D. T. McDOUGAL. Published in the Minnesota Botanical Studies, Part II; 139-142.

THE STOMATES OF *CYCAS*. By MASON B. THOMAS.

OUR PRESENT KNOWLEDGE OF THE DISTRIBUTION OF PTERIDOPHYTES IN INDIANA.
By LUCIEN M. UNDERWOOD.

The purpose of this paper is not primarily to convey any new information although it contains reference to some plants not hitherto reported from this state; nor for the purpose of criticizing what has hitherto been accomplished though it notes the necessity of cutting out some of the plants reported from the state that never belonged to its flora. Its purpose is rather to indicate the paucity of information we have at hand regarding the distribution of even the best known groups of plants; to indicate the extensive portions of the state that are practically untouched by the hand of the collector; to indicate how futile and useless it is to publish or even make manuscript lists of the plants of any region and leave nothing to represent this information aside from a mental recollection or a printed or written line; to outline the limits of our definite in-

formation and to indicate the directions in which future observations may be made useful if accompanied by vouchers that will enable one to verify the accuracy of the information at any future time.

The fern flora of Indiana seems meagre to one familiar with the profusion that is manifested in many other parts of the country. For ferns to flourish there must be more uniformity of moisture, and less irregularity of season than have been manifested in this state in recent years. A climate interrupted by long periods of drought, swamps that lose their water during summer, a soil that is constantly being gullied by rains that flow away quickly from the surface, or areas that are likely to be covered by the alluvium of rivers at times of high water—these are not the conditions under which ferns reach a high state of development in either luxuriance or variety. The ravines along the streams where some moisture is always present, furnish the richest stations where ferns may be found within our limits; permanent swamps will also furnish their quota but the variety is there less than the profusion of certain species.

There are just 50 species of Pteridophytes that now stand on the state list either verified or with more or less probability of verification. Of these, thirty-three are members of the order Filices, and the remaining seventeen are distributed among the five related orders. Of the fifty species, we have verified, either by consultation of accessible herbaria or by personal collection during the past season, all but ten, as follows: *Onoclea Struthiopteris*, *Phegopteris dryopteris*, *Cheilanthes vestita*, *Equisetum sylvaticum*, *E. laevigatum*, *E. robustum*, *E. variegatum*, *Lycopodium obscurum*, *L. inundatum*, and *Selaginella rupestris*.

Certain species have been credited to the state that were based on errors of determination. Among these *Dryopteris Filixmas* (*Aspidium*) is most prominent; this has been variously confused with *D. noveboracensis* and especially with *D. spinulosa*. Its range from Lake Superior northward precludes its being found in Indiana. *Phegopteris polypodioides* was asserted by one correspondent to be found in Jefferson county and he reinforced his statement by the announcement that the plant had been determined at Cambridge. On sending for the plant I found it to be only a young plant of *P. hexagonoptera*, and not a very complete specimen at that. *Lycopodium Selago* was reported by two collectors from Putnam county, but the plant growing there is *L. lucidulum*, of which the rock forms bear a more or less striking resemblance to that alpine species. *Botrychium lunaria* as printed in the list of plants of Dearborn county was a

misprint for *B. lunarioides* as I learn from Dr. Collins himself.

Cheilanthes vestita was placed in the state list from Gibson county, presumably on the authority of Dr. Schneck's Wabash flora, but in a recent letter Dr. Schneck informs me that it does not grow in his vicinity but farther to the southwest in Illinois. There is therefore no certainty that it belongs to our flora.

The only other doubtful plant is *Equisetum sylvaticum*, which seems out of place in southern Indiana. No specimens of the original collection were saved as is too commonly the case in the construction of local floras.

The published state catalogue* may be taken as a datum line for further reports; the additions to the state flora since its publication are as follows:

1. *Dryopteris spinulosa intermedia* (Muhl) Underw. Was first collected and identified by W. S. Blatchley, in Monroe county, and later in Vigo county. G. C. Hubbard collected it in Putnam county, where it is not uncommon.

2. *Asplenium ebenoides* R. R. Scott. A single spond of this species (separate from the main specimen) occurs in the Wabash College herbarium collected in Jefferson county, by J. M. Coulter. It is a rare fern and by many is regarded as a hybrid. It should be sought where its supposed parents, *Camptosorus* and *Asplenium platyneuron*, occur.

3. *Equisetum laevigatum* A. Br. Is reported by Rev. E. J. Hill, from Lake county, and its distribution is likely to be more extensive, as it might be confused somewhat easily with *E. hyemale*, which is widely distributed.

4. *Lycopodium lucidulum* Michx. Was first collected by G. C. Hubbard and D. T. McDougal, at Fern, Putnam county. It is somewhat common in the ravines at that place.

The following species, which appear in neighboring states, are to be looked for in this state:

Cheilanthes gracilis (Fee) Mett. (*C. lanuginosa*) Illinois.

Woodwardia areolata (L.) Moore. (*W. angustifolia*) Michigan.

Dryopteris cristata (L.) A. Gray (Rang includes Indiana.)

Asplenium montanum Willd. Ohio, Kentucky.

Botrychium matricariaefolium A. Br. Ohio. There would seem to be no reason why this and some of the other small species of *Botrychium* should not be found in this state. They are small and often grow in grassy woods and are, therefore, easily overlooked.

*Catalogue of the Phaenogamous and vascular cryptogamous plants of Indiana, by editors of the Bot. Gazette and C. R. Barnes, 1881.

Lycopodium claratum L. May occur on some of the higher land of the state, though its distribution is, in general, more northerly.

Species of *Isoetes* should be found, especially in our northern lakes.

Turning, now, to the counties from which plants of this group have been reported we find that from only 31 counties have we any information whatever and from a number of these only one, or at most, a few common species. From a half dozen we have reasonably full returns and these are mostly those in which a college is located at the county seat. Jefferson leads with 31 species, followed by Putnam and Monroe with 27 each. Clark stands next with 22 and the rest are 20 or mostly much less. It will thus be seen that fully two-thirds of the counties of the state have not been explored botanically and represent the regions into which missionary work should be organized by the Survey. Of those that have been explored, certainly less than a dozen are even fairly well known in their higher or vascular flora.

The distribution of certain species has more than a local interest; this is specially true of those which reach their northern or southern limit in the state. Of these *Polypodium polypodioides* (*P. incanum*) is an example of southern form whose northern range in Indiana as known at present is in the counties of Posey, Gibson, Perry, Floyd, Clark and Jefferson. It is not unlikely that this range will be considerably extended as soon as some one with a sharp eye goes into the other counties of the southern tiers. It is an epiphytic fern growing on oaks and probably other trees. *Asplenium pinnatifidum* is another southern fern which so far has been found only in Gibson county. Of the northern species, *Woodwardia Virginica* is only found in Lake and LaPorte counties and will probably not be found far from the borders of the great lake. *Selaginella rupestris* is at present known only from Lake county,* though its limits are likely to be much extended. The various species of lycopodium are likely to show limited northern range, though *L. complanatum* has been found since the publication of the state catalogue in the counties of Putnam and Monroe, but always on the northern exposures of the hills. The further stations of any of our lycopodiums is a matter of more than local interest. Among other species that seem to have a restricted range we have *Onoclea struthiopteris* reported only from Montgomery, *Phegopteris dryopteris* from Allen, and *Asplenium*

*The reference in the state catalogue to Gibson county proves to be an error, as the plant thus referred to turns out to be a hepatic. The Montgomery county station also needs verification.

ebenoides from Jefferson. While all these need further verification, there is no reason apparent why they should be thus limited, though the last named species is always a rare and local find.

In preparing this paper the following herbaria have been examined: Purdue University, containing 22 Indiana species, many collected by Dr. C. R. Barnes, in Jefferson county; the herbarium of G. C. Hubbard, with 24 species, collected mostly in Southern Indiana; that of Wabash College, with 25 species, largely collected by Dr. J. M. Coulter; that of DePauw University, with 29 species, collected by D. T. McDougal in Putnam and by W. S. Blatchley in Monroe and Vigo; and that of the writer with 35 Indiana species collected in various parts of the state, mostly during the present season.

Valuable notes have also been sent by Rev. E. J. Hill, Dr. J. Schneck, W. P. Shannon, W. S. Blatchley and Professor A. H. Young. It is hoped that the work of a second season will give more definite and fairly complete information regarding the distribution of critical species.

THE ADVENTITIOUS PLANTS OF FAYETTE COUNTY, IND. By ROBERT HESLER.

During the period from 1881 to 1890 the writer kept a close watch upon the flowering plants of Fayette county, noticing particularly the arrival of plants commonly regarded as weeds. During those ten years there were at least thirty-five new arrivals; of these twenty appeared along the railroads, ten along roadsides and waste places, four in meadows, one in a cultivated field. Of the thirty-five, seven again disappeared after a year or two, eighteen merely held their own or spread only to a limited extent, while ten have swept across the county and may now (*i. e.*, 1890) be found almost everywhere.

A brief note on the main features of the county may aid in better understanding the changes in the flora. Fayette county is almost due east of the capital and is the second county from the Ohio state line. The county was formerly densely wooded. The surface, excepting the level northwest portion, is rolling and in places even hilly, especially along the southern boundary. The whole surface is covered by drift. The county is divided from north to south by a broad valley through which the White Water