CONTRIBUTIONS TO THE FLORA OF INDIANA, NO. V. BY STANLEY COULTER.

Since the last report to the Academy, two plants worthy of note have been added to the State flora by Prof. Blatchley.

Vitis rupestris Scheele.—On sand ridges in Lake county. The plant had first been called to my attention by Mr. H. C. Cowles, of Chicago University, and was doubtfully referred to *V. cordifolia* Michx. Later Prof. Blatchley sent me fruiting specimens from the same general region which proved that the plant could not be so referred. The specimens were sent to Prof. L. H. Bailey, of Cornell University, who determined them to be *V. rupestris*. This grape is essentially southern in its mass distribution, its recorded range being from Missouri to Texas, Tennessee and the banks of the Potomac near Washington. It is difficult to understand how it could have wandered so far from its original range, although, as Prof. Bailey writes, "botanists have ceased being surprised at anything from that region."

Juniperus nana Willd., (=*J. communis*, L., var. *alpina* Gaud.).—From Lake county. This form has entered our flora from the north, its recorded range being from Maine to Minnesota and northward.

Much work has also been done during the past year in the extension of the range of various species, largely through the labors of Dr. Hessler, Prof. Blatchley and Mr. W. W. Chipman. It is not, however, so much the purpose of this contribution to report upon the work done during the past year as to summarize the data now in the hands of the survey, in the hope that much needed information may be furnished before the final publication of the State Flora.*

After excluding manifestly introduced forms, recorded as "escapes," together with incorrect references due to a scarcity of material, 1,369 species have been passed upon by the State survey and admitted to the State flora. These species are distributed through 534 genera and 124 families. The list is doubtless far from complete, but under the rules of the survey no plant can be admitted unless verified by an herbarium specimen or one that has been passed upon by some recognized authority. For the most part the admitted species are represented by herbarium

*In previous contributions to the State Flora, the nomenclature followed was that of "Gray's Manual," 6th edition. This was done for the purpose of ready correlation of the facts given in the contributions, with the records of observers. In this contribution it is thought best to use the nomenclature of the "List of Pteridophyta and Spermatophyta," prepared by the Botanical Club of N. A.

specimens, although some forms recorded in Dr. J. Schneck's "Flora of the Lower Wabash," determined by Dr. Gray, have been admitted in the absence of verifying specimens. The same is true as regards a few forms contained in the "Alpine Flora of Indiana," by Dr. A. J. Phinney, which were submitted to Dr. John M. Coulter for determination. If unverified forms, which have been reported from various parts of the State, were added, the number of species would reach at least 1,500. In the summarized statement which follows it will be noticed that the reports concerning many of the more widely distributed families are manifestly incorrect. This is notably true in the case of the grasses and sedges, and scarcely less evident in the case of the umbellifers and the crucifers. It is hoped that botanists throughout the State will examine this list carefully and report needed corrections:

No.	Families.	Genera.	Species.
1	Coniferæ	6	9
2	Typhaceæ	1	1
3	Sparganiaceæ	1	1
4	Naiadaceæ	2	8
5	Juncaginaceæ	2	2
6	Alismaceæ	3	4
7	Hydrocharitaceæ	2	2
8	Gramineæ	27	47
9	Cyperaceæ	11	48
10	Araceæ	4	5
11	Lemnaceæ	2	2
12	Xyridaceæ	1	1
13	Eriocaulaceæ	1	1
14	Commelinaceæ	2	4
15	Pontederiaceæ	2	3
16	Juncaceæ	2	6
17	Liliaceæ	20	35
18	Smilaceæ	1	5
19	Amaryllidaceæ	3	3
20	Dioscoreaceæ	1	1
21	Iridaceæ	3	4
22	Orchidaceæ	14	36
23	Saururaceæ	1	1
24	Juglandaceæ	2	9
25	Myricaceæ	1	1
26	Salicaceæ	2	12
27	Betulaceæ	2	10
28	Fagaceæ	3	18
29	Ulmaceæ	2	6
30	Moraceæ	3	3
31	Urticaceæ	4	4
32	Santalaceæ	1	1

No.	Families.	Genera.	Species.
33	Aristolochiaceæ	2	3
34	Polygonaceæ	4	29
35	Chenopodiaceæ	3	9
36	Amaranthaceæ	3	8
37	Phytolaccaceæ	1	1
38	Aizoaceæ	1	1
39	Portulacaceæ	1	1
40	Caryophyllaceæ	10	27
41	Nymphæaceæ	5	7
42	Magnoliaceæ	2	2
43	Anonaceæ	1	1
44	Ranunculaceæ	16	42
45	Berberidaceæ	4	4
46	Menispermaceæ	1	1
47	Lauraceæ	2	2
48	Papaveraceæ	7	9
49	Cruciferæ	17	39
50	Capparidaceæ	2	2
51	Sarraceniaceæ	1	1
52	Droseraceæ	1	2
53	Crassulaceæ	2	5
54	Saxifragaceæ	8	15
55	Hamamelidaceæ	2	2
56	Plastanaceæ	1	1
57	Rosaceæ	18	54
58	Leguminosæ	27	77
59	Geraniaceæ	2	4
60	Oxalidaceæ	1	3
61	Linaceæ	1	4
62	Rutaceæ	2	2
63	Simarubaceæ	1	1
64	Polygalaceæ	1	8
65	Euphorbiaceæ	5	18
66	Limnanthaceæ	1	1
67	Anacardiaceæ	1	6
68	Aquifoliaceæ	2	3
69	Celastraceæ	2	4
70	Staphyleaceæ	1	1
71	Aceraceæ	1	5
72	Hippocastanaceæ	1	2
73	Balsaminaceæ	1	2
74	Rhamnaceæ	2	3
75	Vitaceæ	2	6
76	Tiliaceæ	1	2
77	Malvaceæ	6	11
78	Hypericaceæ	2	15
79	Cistaceæ	3	4
80	Violaceæ	2	17
81	Passifloraceæ	1	1
82	Cactaceæ	1	1
83	Thymelaceæ	1	1
84	Elæagnaceæ	1	1
85	Lythraceæ	5	5

No.	Families.	Genera.	Species.
86	Melastomaceæ	1	1
87	Onagraceæ	8	17
88	Hallorhagidaceæ	3	7
89	Araliaceæ	2	3
90	Umbelliferæ	21	26
91	Cornaceæ	2	9
92	Pyrolaceæ	2	6
93	Monotropaceæ	2	2
94	Ericaceæ	11	18
95	Primulaceæ	9	13
96	Ebenaceæ	1	1
97	Styraceæ	1	1
98	Oleaceæ	2	6
99	Gentianaceæ	5	13
100	Apocynaceæ	2	3
101	Asclepiadaceæ	4	14
102	Convolvulaceæ	2	8
103	Cuscutaceæ	1	5
104	Polemoniaceæ	2	10
105	Hydrophyllaceæ	3	7
106	Boraginaceæ	8	18
107	Verbenaceæ	3	7
108	Labiatæ	24	56
109	Solanaceæ	5	13
110	Scrophulariaceæ	20	42
111	Lentibulariaceæ	1	4
112	Orobanchaceæ	3	3
113	Bignoniaceæ	2	3
114	Pedaliaceæ	1	1
115	Acanthaceæ	2	3
116	Plantaginaceæ	1	9
117	Rubiaceæ	6	18
118	Caprifoliaceæ	6	18
119	Valerianaceæ	2	5
120	Dipsaceaeæ	1	1
121	Cucurbitaceæ	3	3
122	Campanulaceæ	3	12
123	Compositæ	48	189
124	Cichoriaceæ	7	25
	Total	534	1,369

An examination of the table shows that fifteen families are represented by twenty-five or more species, the composites leading with one hundred and eighty-nine. These fifteen families contain 772 species, leaving 597 species to be distributed among the remaining 109 families. Dominant families, such as these, are, of course, of general distribution throughout the State and have naturally been more closely studied than many of the

others. It is probable that further study will place the sedges and grasses in the third and fourth places instead of the fifth and sixth, in which they are now found. Twenty-seven families are represented by a single species, so far as reports have come to the survey.

Of the 1,369 species, about one hundred and fifty are hydrophytes, about one hundred xerophytes, the remainder being mesophytes. The hydrophytic area has its center in the lake region in the northern counties and in the marsh lands of the Kankakee River, though in a lesser degree occurring along waterways and in local swamp regions. The true xerophytic flora is for the most part confined to the sand regions near Lake Michigan, although along the roadbeds of the older railways true xerophytes are occasionally found.

The mesophytic flora of the State is being largely modified and the hydrophytic flora is rapidly disappearing or assuming mesophytic adaptations because of the extensive drainage of swamp regions. With the drainage of the Kankakee marshes many forms, now a part of the flora, will disappear. Evident modifications of the flora are also occurring as the result of cultivation of the soil, and the removal of forest areas and undergrowth. The effects of these changes are especially noticeable in the virgin forest areas that still remain. In Marshall county such an area carefully preserved from the time of the entering of the land for settlement, has within the last few years shown a marked and rapid loss of value; the tops and larger branches dying, and in many cases the main trunk also showing signs of decay. It is estimated that within five years the timber has decreased in value at least twenty-five per cent. The apparent modifications of conditions are, clearing of adjacent forest areas leaving the virgin tract isolated, cultivation of the lands up to the borders of the area and an enormous increase in the number and carrying capacity of the tile drains. The timber of the area is "mixed," as is the rule in Indiana forests, but no species seems exempt from the effects of these changed conditions. It is possible that the trees may have approached their normal life and that the changed conditions have merely served to hasten the decay properly chargeable to age. That this inference can scarcely be true, is shown from the fact that in Jackson county and the lower stretches of the Wabash much larger and evidently much older forms of the same species maintain themselves in full vigor. In Hamilton county and in other localities the Beeches have been most seriously affected. This is possibly due to a lowering of the soil water line

resulting from tile draining. The root-habit of the Beech would lead us to expect that it would be among the first forms to be affected from this change of the water level in the soil. Such an explanation, however, would not suffice for the Marshall county case, where the deep rooting forms are as seriously affected as the beeches. The part played by the other factors mentioned in the production of this forest decay is yet to be studied. The subject is of such importance that it will be carefully studied before the issuing of the State flora.

The floral regions of the State as indicated by Coulter and Thomson in the "Origin of the Indiana Flora,"* need some modification in the light of a more extended knowledge of the flora of the State. The seven floral districts of Coulter and Thomson were based largely upon geological horizons and altitude, factors which are quite subordinate in the limited area of Indiana in the determination of plant distribution. The effect of altitude must be very slight in an area in which the lowlands are about three hundred feet above sea level and the highlands only from 900-1,300 feet above. The number of plants whose distribution is limited by geological horizons must necessarily be very small in a State so largely affected by the drift and in which the amount of soil derived from the country rock remaining *in situ* is so comparatively insignificant. It is not meant that these factors may not be of importance in other regions or when widespread areas are considered, simply that in Indiana they are not dominant and do not furnish the most natural basis for the division of the State into floral districts. Without doubt, within our area, waterways furnish the dominant factor in determining plant distribution. That this is true can be easily verified by checking the mass distribution of almost any abundant form upon a hydrographical map of the State. This is not the place to discuss in detail the proposed redistricting of the State, but during the coming season outline maps indicating approximately the boundaries of the proposed floral regions will be distributed to the working botanists of the State for suggestion and criticism.

The general movement, especially of our summer and fall blooming plants is toward the northwest. This was of course to have been expected from the direction of the prevailing winds at the time of such dissemination. This movement is quite marked and can be noticed in almost every instance in the case of plants accidentally introduced into the State through the agency of railroads. In the case of the Russian thistle

*Indiana Geological Reports, Vol. XIV., p. 255.

and other recently introduced forms this fact is very apparent. Local conditions may modify this movement somewhat. Thus in the northwestern counties of the State the movement of the plants, especially those of the sand soils is to the south and southeast because of the winds from Lake Michigan. The very slight overlap of the characteristic prairie flora of Illinois into corresponding regions in Indiana is well known, and has its explanation in the above facts. An examination of the flora of the State, and a consideration of the mass distribution of the forms involved shows that a very large proportion of it is from the east and southeast, very little from the west. Marked overlaps occur with the true southern forms in the southwestern counties, and with northern forms in the Lake region, but this is to be expected from the topographical and hydrographical features of the regions.

The weeds of the State have received much attention, and while a full treatment of the subject is reserved for the final report of this division of the survey, a few facts are here given in the hope of securing additional data bearing upon this very important subject.

Salsola kali tragus (L.) Moq., the Russian thistle has not spread to any great degree. As indicated in a former paper,* its appearance in Lake and Noble counties was reason for the belief that its distribution in the State would be limited, a belief happily justified by the facts. Its disappearance from the regions in which it is now found is but a question of time.

Lactuca scariola L., the prickly lettuce, is rapidly spreading throughout the State and is becoming one of our most dangerous forms. It spreads with extreme rapidity and by its rank growth shades out many smaller forms and takes sole possession of large tracts. In a piece of waste land covering about ten acres, I noted, three years ago, perhaps a half dozen plants. Last year the land was entirely taken by the lettuce. None of our weeds demands more vigorous measures for its repression, and its first appearance in any region should be the signal for the beginning of repressive measures.

Solanum rostratum Dunal, widely heralded a few years ago as a dangerous weed, has not spread widely and is practically confined to the regions in which it first found lodgment. It was first reported from Vigo and Sullivan counties having come in from the west, and this position

* *Noteworthy Indiana Phanerogams*, Stanley Coulter, Proceedings Indiana Academy of Science, 1895, p. 192.

rendered the probability of any great spread over the State exceedingly slight. The plant should, however, be carefully watched, although at present not of sufficiently general distribution to take rank among the dangerous weeds of the State.

Erigeron annuus Pers., white top, which had apparently been practically eliminated from the list of weeds of the State, has during the past two years appeared in great abundance throughout the State. In many cases it has entirely taken meadows in which it had been practically unknown for years. Reports of its occurrence came to me from a large number of counties with requests for an explanation of its sudden reappearance. No satisfactory explanation has as yet suggested itself, but as the plant yields readily to careful cultivation it may be considered as annoying rather than dangerous.

Rumex acetosella L., field or sheep sorrel, while not a conspicuous landscape feature is in many respects to be considered the most dangerous weed in the State. It spreads rapidly and because of its early leafing and habit of growth supplants the grass and other desirable forms. It sets root deeply and resists successfully all of the ordinary means of weed eradication. Apparently so long as the smallest portion of the root is left in the ground there is danger ahead. I have records of many cases in which the farmer has given up what seems a hopeless contest and has abandoned his fields.

In the light of to-day, the introduction of new weeds is not to be greatly feared. The persistence of our indigenous forms is, however, quite a different matter. The presence of these noxious weeds is not merely a constant disgrace, but also a constant menace. The passage and enforcement of wisely devised weed laws would prove of incalculable benefit to the State, and it should be the part of botanists to urge the passage of rational and workable laws upon this subject.

Experiments in Germination of Composites. By Stanley Coulter.

[Abstract.]

A report upon one hundred experiments in the germination of composites, confirming positions taken in a paper presented to the Academy last year. These positions were as follows:

1. The achenes of composites show a low germination percentage.