

Flora of Tennessee  
and  
Philosophy of Botany



AUGUSTIN GATTINGER







*Augustin Göttinger aet. 76*

GUTTA CAVAT LAPIDEM NON VI SED SÆPE CADENDO.--HORAT.

NOT BY FORCE, BY FREQUENT FALL ALONE  
A DROP IN TIME CARVES OUT A STONE.

# THE FLORA OF TENNESSEE

AND

## A PHILOSOPHY OF BOTANY

RESPECTFULLY  
DEDICATED

TO THE CITIZENS OF TENNESSEE

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BY  
AUGUSTIN GATTINGER, M.D.

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Published by Authority of the State through the Bureau of Agriculture

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1901

## APPROPRIATION FOR THIS VOLUME.

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AN ACT to provide for the acceptance by the State of a work on botany, prepared by Dr. A. Gattinger, and to make an appropriation for its publication and distribution.

Whereas Dr. A. Gattinger has offered to present to the State a work prepared by him, on the botany of the State of Tennessee; and

Whereas the dissemination of such information among the people of the State is of the highest importance and value, and eminently worthy of the aid of the State; therefore,

SECTION 1. *Be it enacted by the General Assembly of the State of Tennessee,* That said work so presented by Dr. A. Gattinger be accepted by the State, and that the Commissioner of Agriculture be, and is hereby, empowered and directed to have said work printed and distributed among the citizens of Tennessee.

SEC. 2. *Be it further enacted,* That the sum of six hundred and fifty dollars, or so much thereof as may be required, is hereby appropriated for the purpose of printing, publishing, and distributing said work.

SEC. 3. *Be it further enacted,* That this Act take effect from and after its passage, the public welfare requiring it.

Passed April 17, 1901.

NEWTON H. WHITE,  
Speaker of the Senate.

E. B. WILSON,  
Speaker of the House.

Approved April 18, 1901.

BENTON M'MILLIN,  
Governor.

## ERRATA.

- Page 3. Quotation should be credited to Virgil.
- Page 27. For "Graborchard" read "Craborchard."
- Page 27. Below "border" insert "O. S." (Over the State) and "M." (Medicinal).
- Page 28, 10th line. For "bulifera" read "bulbifera."
- Page 28, 20th line. For "Novæboboracensis" read "Novæboracensis."
- Page 29, 13th line from below. For "thelypteroides" read "thelypteroides."
- Page 39, middle. For "an8d" read "and."
- Page 52, 14th line from below. For "uburnea" read "eburnea."
- Page 55, middle. For "uniformis" read "reniformis"
- Page 64, 14th line from below. For "Potty" read "Putty."
- Page 76, 4th line from below and higher. For "champion" read "campion."
- Page 78, 12th line from above. For "dichtotoma" read "dichotoma."
- Page 84, 11th line. For "Malapcena" read "Malapcenna."
- Page 86, 12th line from below. For "Thelipadium" read "Thelipodium."
- Page 97, 9th line from below. For "Scheele" read "scheele."
- Page 100, 3d line. Before "Gattingeri" insert "C."
- Page 105, 8th line. For "Thephrosia" read "Tephrosia."
- Page 115, 16th line. For "W. W. Ashe from" read "W. W. Ashe. From, etc."
- Page 118, 9th line from below. For "moshata" read "moschata."
- Page 120, 8th line from below. For "gymmanthum" read "gymnanthum."
- Page 120. After "Hypericum Kalmianum" insert "H. aureum Bartram. Limestone cliffs of M. Tenn. Frequent. July."
- Page 122, middle. For "Criocarpa" read "Eriocarpa."
- Page 123, 8th line below. For "Caney Fork" read "Collins River."

- Page 135, 3d line and below. For "pimpernell" read "pimpernel."
- Page 138, 6th line. For "Pleuresy." read "Pleurisy."
- Page 142, 4th line and below. For "gomfrey" read "comfrey."
- Page 142, 12th line from below. For "raccoon" read "puccon."
- Page 146, below. For "majoran" read "marjoram."
- Page 151, below "Leptandra." "M." omitted.
- Page 152, 6th line from below. For "Lausewort" read "Louseworth."
- Page 154, below. For "leptosyachya" read "leptostachya."
- Page 154, 3d line. For "proboscoidea" read "proboscidea."
- Page 155, 3d line. For "cocerulea" read "coerulea."
- Page 158, 17th line from below. For "Cururbita" read "Cucurbita."
- Page 160, 12th line from below. For "Leontedon" read "Leontodon."
- Page 162, middle. For "strumaricum" read "strumarium."
- Page 163, 9th line. For "tencrifolium" read "teucrifolium."
- Page 163, 13th line. For "rotundifoium" read "rotundifolium."
- Page 165, 2d line from below. For "corybosus" read "corymbosus."
- Page 170, 10th line. For "Braunneria" read "Brauneria."
- Page 170, 4th line. For "Lapachys" read "Lepachys."
- Page 172, middle. For "Helienium" read "Helenium."
- Page 180. For "Danthus" read "Dianthus."
- Page 187, below quotation. Read translation: "Time obliterates opinions of men, but it confirms the decisions of nature."
- Page 193, middle. For "Arbella" read "Arbela."
- Page 204, 21st line. For "creed" read "greed."
- Page 209, Latin quotation. For "etque" read "atque."
- Page 216, 11th line. For "Sarcen" read "Saracen."
- Page 218, 7th line. For "A.D. 33" read "A.D. 337."
- Page 218, 17th line. For "556" read "350."
- Page 234, 12th line from below. For "grassculum" read "grassculm."
- Page 241, 7th line. For "him" read "man."
- Page 243, middle. For "lappægue" read "lappæque."
- Page 244, German quotation. For "Such" read "Such'st."
- Page 272, 11th line from below. For "nutriton" read "nutrition."

# CONTENTS.

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## FLORA OF TENNESSEE.

PREFACE .....	3
AREAL BOTANY .....	11
SYNOPSIS OF THE FLORA .....	27
REVIEW OF FAMILIES .....	176
INDEX TO GENERA .....	178

## PHILOSOPHY OF BOTANY.

EVOLUTION OF BOTANY .....	187
FORESTRY .....	241
INTRODUCTION OF A NATIONAL FORESTRY POLICY...	245
MODERN THOUGHTS ON ORIGIN, EVOLUTION, AND SIGNIFICANCE OF LIFE .....	263



# PREFACE.

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**Coelum non animum mutant qui trans mare currunt.\***

The fifth decade of the past century proved disastrous to the patriots of Germany who were seeking liberty and progress, and no hope was left for recovery from the defeat sustained or for better success in the near future by a renewal of the struggle for liberal government. For the first time in the history of the Bavarian capital of Munich, a meeting of discontented citizens was held, to deliberate upon joint action to secure better and safer means of emigration to the United States of North America. Artists, professional men, mechanics, and farmers, people of good standing in society and amply provided financially, to the number of nearly two hundred, composed the meeting.

At this time an association of students of the University of Munich, of which I was a member, resolved to celebrate in a solemn fête Washington's birthday, a proceeding never before heard of, but fully in accord with the sentiments of this party, which in these turbulent times represented the liberal movement in the university. The celebration was a great success, and speeches and eulogies on Washington and Jefferson, Franklin and other heroes were indulged in fervently and unreservedly.

The open avowal of republican institutions was immediately denounced as a provocation, too flagrant to be allowed to be passed by, and actions were instituted by the authorities. Several of the participants had to leave the city. Called before the university tribunal, I was released on my pledge to emigrate. I regret to say that I have never since found an opportunity to celebrate this national festivity with the same pathos and enthusiasm as on this memorable twenty-second of February, 1849.

Severance from beloved friends and the ancestral soil is a bitter and mournful task, and recollection of it even now clouds the serenity of the moment. But the genius of love mitigated my dis-

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\* New stars, new sights the pilgrim meets;  
He stays the same in thoughts and deeds.

tress, for the one whom I had chosen for my companion through the turmoils of life consented to go with me, and we joined hands at the American consulate at Havre before sailing.

These circumstances account for my appearance in Chattanooga, Tenn., in June, 1849, which place I reached by stage from Dalton, Ga., the terminus of the Georgia and South Carolina Railroad. I was fascinated by the magnificence of the scenery; but there were but few dwellings, and these of poor construction, as might be expected in a recently-settled place. After a short delay, a small side-wheel steamer blew its whistle and brought me and my party after three days' navigation up to Kingston, on the Clinch River. This little town looked clean and airy, and, pleased with the friendliness of the citizens, we made it the base of operations for exploring the vicinity. Weary of traveling and wishing to enter on the practice of my profession, I was easily fascinated by a romantic spot called "Cave Spring," eight miles to the west of Kingston, at the time occupied by an older physician, who intended to go West. I purchased the place in partnership with my brother-in-law, the late George Dury, a Munich artist, whose exquisite paintings now adorn the State Library in the Capitol. Unfortunately, we did not take into consideration, in making this purchase, the possible—or, rather, impossible—revenues to be derived from this possession, a circumstance which ultimately necessitated the abandonment of our farming experiment at a great sacrifice.

The transfer from a buoyant German city to this silent retreat was to me a stimulus to concentrate my attention outside professional duties and equestrian hardships to the study of the botany and geology of the country. At my *alma mater*, the University of Munich, it was obligatory to pass through a course of natural sciences—chemistry, mineralogy, and botany—before being admitted to the medical department. A two-years' course in general and medicinal botany initiated me into the science. Moreover, I had from earlier school years been a botanical collector, and had given a great deal of time to these studies.

After the abandonment of Cave Spring I acquired some property in Charleston, Bradley County, where I remained until I accepted, in 1858, the charge of resident surgeon at the copper mines of Ducktown, situated in the high mountains of East Tennessee, adjoining North Carolina and Georgia. The new situation was socially very agreeable, moderately remunerative, and possessed botan-

ically and geologically so many and so diversified points of interest, that a whole lifetime of a competent investigator could not exhaust and unravel all the problems and collect the various plants, minerals, and rocks. A prominent member of the United States Geological Survey, who is intimately acquainted with this region, assured me in a recent correspondence that in the entire area of the United States he knows of no part which, in an equal territory, possesses so great a diversity and complication of structure. I enjoyed and utilized industriously my opportunity, although with great diffidence, in the results of my analyses, for want of scientific botanical literature, especially of the American.

Having been fifteen years in the saddle, traversing more than one-half of East Tennessee, throughout the Cumberland Mountains and all the valleys between Walden's Ridge and Smoky Mountain, I held in my mind a well-connected panorama of the natural vista at all seasons of the year.

Possessed, as I believed myself to be, of a moderate and quiet enjoyment of intelligent and useful pursuits, it came suddenly to pass that I had to bear my share of the agonies and convulsions of the Civil War.

Opposed to the disruption of the Union, knowing from experience the misery of a great nation split into petty principalities (as was the case with Germany for centuries), seeing in the growing greatness of this government the future liberation of all nationalities through its physical power and moral influence, I advocated the cause of the Union, and created such displeasure to my former friends that I found it advisable to leave my domicile and part with my family. On a cold, starry March night, afoot, no money, with a small satchel as traveling outfit, I wound my way through the Ocoee gorge and reached the town of Cleveland, forty miles distant, without an accident.

The government in which I had put my faith and trust took me under its care, sent me to Nashville, and put me into service as an assistant surgeon. After the expiration of my term and recovery from a severe malarial fever, which temporarily disabled me for army duties, I accepted from the military Governor, Andrew Johnson, the position of State Librarian, which I held during five years, whereby I greatly improved my acquaintance with scientific American literature. Moreover, I found such helps in pursuit of making collections as I never before or after-

wards enjoyed. Through the kindness of the military superintendent of the Nashville, Chattanooga and St. Louis Railway, Gen. William T. Innes, I was favored with the privilege of using all trains, passenger and freight, at all points for travel. This permit continued four years, until the administration of the railroad was changed, and when I also lost my office as State Librarian. From this time on I carried on an interesting correspondence with prominent botanists in all parts of the United States, and by submission to the approval of our leading botanical authorities, I secured the correctness of specific determinations. I am under great obligations to the late Dr. Gray, of Cambridge, Mass.; the late Dr. Engelman, of St. Louis, Mo.; the late Dr. G. Vasey, of the United States Department of Agriculture; the late Dr. Chapman, of Apalachicola, Fla., for their assistance.

It is much to be regretted that Dr. Rugel, who, about fifty years ago, resided in the vicinity of Greeneville and made valuable collections and discoveries in that vicinity and the mountains of East Tennessee and North Carolina, died without leaving a record of his work. His collections came in the possession of Mr. Shuttleworth, of England. *Senecio Rugelia* Gray, *Plantago Rugelii* Decaisne, *Siphonochia Rugelii* Chapm. commemorate his name.

My collections were in much request for exchange, as they contained many novelties and were well prepared. The area of Middle Tennessee was an unexplored region, botanically, and I claim the honor of being the pioneer in this field. At the meeting of the American Association for the Advancement of Science, held in Nashville in 1877, the botanical division encouraged me to prepare a catalogue of plants or flora of Tennessee, which I was assured would be received favorably by all American botanists. I consented to do so, and fulfilled my obligation in 1883 by publishing a small volume of one hundred and nine pages, a systematic enumeration of seventeen hundred and eight species. It was printed at my own expense, and distributed gratuitously among the schools of the State, and such patrons of botany as applied for it. This movement helped me very much in the furtherance of my enterprise, as it brought together all persons within the State who had an interest in botany, and had collected more or less. With this catalogue in hand, every collector in Tennessee was enabled to see whether or not it contained all the species which he had found himself, and he would then report

to me his own discoveries. I soon received valuable contributions from my esteemed friend, the late Gen. E. Kirby-Smith, at Se-wanee; Prof. T. M. Bain, now of the Agricultural College, Knoxville; Prof. A. Ruth, superintendent of public schools in Knoxville; the late Mrs. Lydia Bennett, of Fisk University, Nashville; Dr. G. Egeling, pharmacist, Memphis; and Prof. Lamson F. Scribner and Mr. Kearney, both now of the Botanical Division of the Agricultural Department at Washington. Much valuable information I drew from the "Memoirs" of the Torrey Botanical Club, in a report on the flora of Western North Carolina and contiguous territories, made by John K. Small and A. A. Heller in the season of 1891, and published in February, 1892, followed by a similar report made in the season of 1892 by John K. Hall and Anna Murray Vail, on the flora of Southwestern Virginia. Both areas extend to the geographical borders of Tennessee, along mountain ranges and water courses, which continue into the upper border counties of Tennessee without any difference in the nature of the soil or elevation. The flora being necessarily identical, I took the privilege to add to my list all such species which yet had not been collected within the adjoining boundaries of the State. Most recently I have been favored with valuable information and additions from the botanists of the Biltmore Botanical Institute—Messrs. C. D. Beadle, F. E. and C. L. Boynton, and T. C. Harbison—published in "Biltmore Botanical Studies," Vol. I., No. 1; William Wesley & Son, London. From all these sources and my own continued collections, I can now add over four hundred species not contained in the first edition, and am, moreover, enabled to amend and correct many errors occurring in the same.

For the census of 1880 I collected for Professor Sargent, the superintendent of the botanical division of the census, specimens of the timbers of Tennessee. I also collected for the mineral division of the same census the building stones of the State, with the exclusion of the marbles. This collection consisted of forty pairs of cubes, all of different character, four by four inches. This, I think, was the first time the granites of Tennessee were brought to notice in beautiful specimens. The collection also contained the sandstones—the beautiful white one from the Hiwassee Valley—and the argillites, conglomerates, slates, and limestones, including the oölitic or Bowling Green stone, which is used in the construction of our customhouse.

In April, 1878, I assisted Hon. J. B. Killebrew, then Commissioner of Agriculture of the State, in the publication of his work on the Tennessee grasses and forage plants, by giving him the list of grasses actually collected by me, and revising the manuscript. In the same year I prepared a publication on the trees and shrubs suitable to the soil and climate of Nashville for the Board of Health of the city of Nashville.

In 1883 I was engaged by Hon. A. J. McWhirter, then Commissioner of Agriculture for the State, as an assistant in his office and in collecting minerals, building stones, and plants for the Louisville Exhibition and other exhibitions: but after the close of these exhibitions I was again dismissed, to be followed in office by the commissioner's own son, Mr. L. B. McWhirter.

In 1894 Hon. T. F. P. Allison, Commissioner of Agriculture, intrusted me with a publication on the medicinal plants of Tennessee. The work was carried out to mutual satisfaction.

In 1897, in connection with the Centennial Exposition, I was a member of the Committee on Minerals and Mines of the State, of which Professor Safford was chairman. I procured a rich collection of the copper ores and smelting products of the Ducktown Mines and Smelting Works, inclusive of a rich display of ingots. I also exhibited a large collection of Tennessee granites in blocks, with one side polished, from Wolf Creek, Carter County, and from near Elizabethton, on the line of the railroad which extends from Johnson City to the Granberry Mines, in North Carolina.

At the time of my publication of the medicinal plants, my botanical collections had so far progressed that I felt satisfied that within a limited time not many more additions could be made, and that I had very nearly reached the limits of the record. In preparing the new edition I adopted the new nomenclature and made some other changes, for which I give an explanation in the following paragraphs.

One of the greatest burdens and causes for confusion in systematic botany had been the constantly increasing synonyms for the same species. Much of it originated from the disjointed labors of distant botanical writers describing the same plants; often from imperfect specimens, while unacquainted with the past or contemporaneous labors of others in the same field; and in not a few instances it resulted from the abuse of personal prominence and disregard of the merits of others. This disturbing condition would

never have come to an end, if the great majority of naturalists had not recognized the necessity of accepting the name given by the discoverer of a plant, whenever the name is conformable to pre-established rules. Priority should be a fixed and positive limitation, which admits of nothing arbitrary or partial.

On the invitation of Alphonse De Candolle, an International Botanical Congress was held in Paris in 1867, to which botanists from all countries were invited, and the most important subject discussed was botanical nomenclature. Mr. A. De Candolle, author of the "Prodromus," presided. He had drawn up a most carefully considered code of rules to govern botanists in their writings, and this code was submitted to the assemblage of botanists, each rule being formulated and modified as the majority deemed wise. Finally the whole was printed and circulated. The fundamental principle of these laws was priority of publication, with adequate descriptions. Unfortunately it was made retrospective, without any sufficiently defined statute of limitations. Among zoölogists the Stricklandian code governs—known as the "Rules of the British Association." It was signed by Charles Darwin and Professor Hensley. A revision was made in 1860 by Mr. A. R. Wallace, P. L. Clayton, Professor Balfour, Professor Huxley, Dr. J. D. Hooker, and Mr. George Bentham. A still further revision of the same occurred in 1865. In the preface to this code occurs this sentence: "No one person can subsequently claim an authority equal to that possessed by the person who is the first to define a new genus or describe a new species."

The adoption of the Paris code did not meet an immediate and universal acceptance. The conflict with the interests of authors and publishers of works of great value, the issue of which had been commenced and was still progressing, was a matter of some consideration. The nonattendance of English botanists at the Paris Congress was perhaps due to this cause. The annoyance created by such radical changes is a very great one, and a burden pressing heavily upon the older botanists, who are not so well fitted to recast their memories as the younger generations, who will reap the benefit of the movement. There was also some friction with us, even after the meeting of the American Association for the Advancement of Science, held in August, 1892. The botanical division adopted at this meeting the Paris code of 1867, with some modifications. At the following meeting, in Madison, Wis., in

1893, an additional amendment was adopted, and a committee of the association was appointed to elaborate a list of *Pteridophyta* and *Spermatophyta*, growing without cultivation in Northeastern North America. This work was subsequently published in 1894 as the fifth volume of the "Memoirs" of the Torrey Botanical Club. The synonyms given under each species in this work include the recent current names, and thus avoid any difficulty in identification.

The recently published volumes of "The Illustrated Flora" will, on account of the helpfulness of the illustrations, soon find their way to general favor as an indispensable guide for less expert collectors, for which the innovation therein adopted has no harassing inconvenience. In view of this prospect I have also, although reluctantly, adopted the new nomenclature. I have, furthermore, given in this edition the English vernacular names and some derived from the Aborigines, where such are known, but did not think it proper to make, in their absence, English translations from the Latin names. A general botanical and geological chorography or natural aspect of the area precedes the systematic enumeration of the species.

In the year 1890 my entire collection, the second largest herbarium in the South, came into the possession of the University of Tennessee, at Knoxville, and as I cannot, by my advanced years, expect to add much to its enlargement, I am happy to know it is in hands under whose care it will be well preserved and utilized. While the pursuit of botany never brought me any financial advantages, I acknowledge that it was a mighty protector in keeping me out of the way of social corruption, and it gave me many hours of the purest enjoyment of life and brought me into friendly relations with many excellent men and women.

In order to gain a wider circle of readers and to give further inducement to the study of botany, I have added an "Epitome of the History of Botany," a "Treatise on the Introduction of a Forestry Policy in the United States," and a "Treatise on Protoplasm and Origin of Life."

A list of authors whose works have been consulted or literally quoted is given at the end of the work.

I am well aware that there is much scope for improvement of this work, and I turn to the younger generation of botanists, who can work under more favorable conditions, soliciting their coöperation in extending and perfecting it.

Very respectfully,

A. GATTINGER, M.D.

# Areal Botany or Regional Distribution of Plants.

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Engaged with laurel, oak, and fir,  
'Midst fern and sedge, the viler or the rare,  
In dismal swamps, 'neath cypress grand and fair,  
Where snakes and tangles bring despair;  
On lofty crags, in clouded sphere,  
Where eagles built their artless lair,  
And, whistling, swing in upper air;  
Onward, though of waning strength aware,  
Seeking truth, with firm resolve I dare  
To plead my right to reason, doubt, or err.

## GENERAL ASPECT OF THE FLORA.

The boundaries of Tennessee are embraced within the great Atlantic forest region. The whole of this territory was in its virgin state, an immense expanse of varied woodlands, being in the lowlands of dense and massive growth, filled with pathless jungles of cane and shrub, or, away from the water courses, on the uplands, reduced to open and airy groves (with great diversity of timbers), the barrens. Here a dense sward covers the ground and herbaceous growth prevails. Mountain forests are always of greater uniformity in distribution of timbers.

Nearly one-third of the entire area is now reduced to fields or occupied by buildings or roads. Canebrakes have well-nigh disappeared, and the forest is in all accessible regions depleted of valuable timber.

Immigration of foreign and retirement of native species continually modify the aboriginal flora and tend to weaken characteristics due to presence of peculiar plant forms, or collocation of species, by the intricacies of mutual predilection and adaptation to surroundings.

Such areas, which differ among themselves conspicuously in such properties, admit of the establishment of natural floral arrondissements.

Differences of elevation, diversity in elementary constitution

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I have retained in this chapter the old nomenclature of Drs. Gray and Chapman, for the benefit of those using their manuals.

of the soil, and inequality in distribution of atmospheric humidity are, in our territory, sufficiently potent to mark out four distinct regions:

I. The high crests of the Alleghany Mountains, formed of Grauwake slates, gneiss, or mica schists, with an elevation of from 4,000 to 6,600 feet. Subalpine region.

II. The western slopes of the Alleghanies and their outlying spurs, and the Cumberland Mountains. Sandstones and slates. Mountain flora. Elevation, from 2,000 to 4,000 feet.

III. Valley flora, the lower division of which is coextensive with the limestones (Silurian) of East and Middle Tennessee. Elevation, from 350 to 500 feet. The upper division, or highlands, has siliceous and argillaceous soils, sometimes limestones of the sub-carboniferous formation. Elevation, about 1,000 or 1,200 feet. The former division is characterized through its cedar glades; the latter is the region of the oak barrens.

IV. West Tennessee, situated between two powerful rivers, with much level or only gently undulating surface, owes its peculiarities to the abundance of swampy lands and predominantly argillaceous soils, in connection with a more humid atmosphere.

#### SUBALPINE REGION.

The dividing line between the States of North Carolina and Tennessee passes over and along the crest of the highest ridges and peaks, known as the Unaka, Great Smoky, Bald, and Frog Mountains. Their average elevation is about 5,000 feet, but about twenty-two summits are 6,000 feet or more. The highest stretch lies between the French Broad River and the Little Tennessee River, with fifty-five high points, eighteen of which are over 6,000 feet. Clingman's Dome, by a few feet the highest, rises to the very respectable altitude of 6,600 feet above tide water, according to the measurements of Prof. Arnold Guiot, of Princeton, N. J. (Vide *American Journal of Science*, September, 1857, and November, 1860.) Geologically they consist of Huronian schists and gneisses, and in some spots of Laurentian granites.

Not one of these high crests presents a bleak crag, bare of vegetation, nor is there a timber line. Some are evenly timbered throughout, others support only a scattered and stunted arboreal growth, and some bear only a low shrubby or herbaceous vegetation. The absence of timber on the so-called "Balds" is perhaps

due to waves of excessive cold; such, at least, seem the dead trunks, looming up here and there, to suggest.

#### VALLEY LANDS.

If you approach the mountains of East Tennessee from their western slope, taking a direct course eastward, traveling from Cleveland along the road which leads to the copper mines in Polk County, you are constantly uphill and downhill for nearly fifteen miles, intersecting a series of low parallel ridges. The soil is directly derived from the underlying rock, one of the lowest members of the Silurian formation, and only very small strips of alluvium line the few streamlets which you have to cross. Along this line is also the watershed, between the Tennessee River system and the Coosa River. It belongs mainly to that class of land which, all over the State, is not very favorably known as gravelly hills, from a superficial covering of sharp cherty or dolomitic gravels of all sizes, generally small, but often also protruding in dykelike masses. Magnesian and siliceous rocks, no matter to which geological age they may belong, are, all the world over, the most unavailing mineral constituents of soil, and, for the lack of alkali and phosphates, are soon exhausted by crops which consume much of these elements. The generally thin covering of humus supports a meager herbage, and cattle have to be on their feet all the while in defense against starvation. Black-jack oaks, Spanish oak, black oak, sourwood, dogwood, slim chestnuts, loblolly pine, scrub pine, and here and there a yellow pine which has escaped the ax, make up the forest, which, throughout this region, is stripped of the merchantable timber. I have, myself, within thirty-five years, witnessed the rise and fall of this empire. The short space of time which passed between the first harvest and hopeless abandonment had not yet prostrated all the dead timber girdled in the first clearing, when the returns became too small to pay for the expense of cultivation. Stunted sassafras and persimmon, here and there a loblolly pine, sumacs (*Rhus glabra* and *copallina*), are the growth by which regenerating nature tries to reclaim those ruined lands. The herbage consists generally of very humble plants; the buttonweed (*Diodia teres*), Virginia plantain (*Plantago Virginica*), the flowering spurge (*Euphorbia corollata*), butterfly weed (*Asclepias tuberosa*), two species of broom grass (*Andropogon Virginicus* and *scoparius*), the foxtail grass (*Setaria glauca*), the poverty grass (*Aris-*

*tida dichotoma*), the common evening primrose (*Enothera biennis*), the mullein (*Verbascum thapsus*), the never-failing ragweed (*Ambrosia artemisiarfolia*), a few solidagos and asters (*Aster ericoides* and *dumosus*), constitute the larger herbs. In places the ground is spread over by the prostrate low blackberry (*Rubus trivialis*), or cinquefoil (*Potentilla Canadensis*), while the high blackberry (*Rubus villosus*) replaces former fence rows. Cattle find an insufficient support from browsing on the Japan bush clover (*Lespedeza striata*), white and yellow clover (*Trifolium repens* and *procumbens*), and about two nutritious grasses, the crop grass (*Panicum digitaria*), and a species of paspalum. The botanist finds but few rarer species to compensate him for his exertions, and rejoices to find himself at last in full sight of the mountains, in descending the eastern slope of a ridge which borders the Ocoee River. This broad mountain stream, swiftly gliding over his pebbly bed, is skirted by a stately and diversified growth of timber—Herculean sycamores and massive cottonwoods, immense lindens and poplars, slippery and white elms, ashes, white walnut, and box elder of stately growth. The water oak and willow oak (*Quercus aquatica* and *Quercus phellos*), with elegant outline and glistening color of foliage, are contrasted by the chalk-white trunks of the gray birch (*Betula lutea*), with ever-tremulous foliage, on delicate sprigs. Now and then a holly (*Ilex opaca*), silver-bell tree (*Halesia tetraptera*), and an umbrella tree (*Magnolia umbrella*) present themselves as outliers from the upper regions. Crossing the river, the romantic hamlet, Parksville, is soon reached, the gateway to the great mountains, opening between two mighty pillars, the Chilhowee Mountain to the left or north side, and the Round Mountain to the right or south side. Before reaching the milldam, the last ledges of chert and dolomite are passed, and quartzite and siliceo-argillaceous conglomerates are the country rocks. Narrow but rich bottoms, encompassed by high and steep mountain sides, the latter heavily timbered, give room for small and scattered farms, well cared for and successfully managed.

#### MOUNTAIN FLORA.

The lower mountain flora is spreading around on all sides, clothed in deeper green or gaudier colorings. As we ascend the river, which gushes with deafening roar from shoal to shoal, we discern how every submerged rock is densely coated with a rough,

wool-like growth, an inch or two long, threadlike, the flowers the size of pin heads, the mountain river weed (*Podostemon abrotanoides*), pondweeds float in long streamers (*Potamogeton hybridus*, *Potamogeton Claytoni*). An endless variety of shrubbery constitutes the undergrowth. The *Kalmia* (*Kalmia latifolia*), worthy companion to the great mountain laurel (*Rhododendron maximum*), and four azaleas, equally beautiful (the fragrant clammy azalea), merit the highest praise and are very abundant. Various other kinds of the heath family, with white and bell-shaped flowers and evergreen foliage, are characteristic features of the scenery. Foremost, the dense masses of *Leucothoë Catesbæi*, a tall shrub with wand-shaped, recurved branches and dense pendulous racemes, exhaling the odor of chestnut flowers; *Leucothoë recurva*, the *Andromeda floribunda*, and the white alder (*Clethra acuminata*), either as bush or small tree, all belong to this type.

A singular and unparalleled display is reserved for the untiring botanist if he climbs to the highest cliffs of the Chilhowee, from whence at one glance he can survey the whole valley of East Tennessee until his eye meets, in the smoky distance, the rectilinear course of Walden's Ridge. At an elevation of about 2,500 feet he descends along vertical cliffs of Potsdam sandstone, dense groves of the fringe tree (*Chionanthus Virginica*), in greater vigor and abundance of flowers than he had ever before witnessed. Several rare ferns grow in the crevices, such as the woolly-leaved *Cheilanthes* (*Chil. tomentosa*), grayish green on the upper surface and rusty colored underneath; the *Cheilanthes vestita*, of similar habit, but not quite so attractive; the neat little *Asplenium Trichomanes* and *Asplenium montanum*. *Polypodium vulgare* and *incanum* and some larger species of *Phegopteris* and *Aspidium* abound. Orchids of rare beauty nestle in the deep mold—*Bletia aphylla*, *Goodyera pubescens*, *Pogonia ophioglossoides* and *verticillata*, *Cypripedium spectabile*, *acaule* and *pubescens*.

From the twelfth to the sixteenth mile above Parksville, the cañon cuts through the highest part of the Big Frog Mountain and opens out into a rugged plateau or basin formed of micaceous, copper-bearing rocks. From Greasy Creek, three miles above Parksville, to the Mundie Bluff, which is within the heart of the great mountain chain, dark-colored, argillaceous or roofing slates, porphyritic from disseminated cubes of pyrites, and grayish micaceous slates build up the towering and grotesque masses and spurs

which lead up to the ridgelike summit. An untouched virgin forest covers these slopes—principally splendid white pines, mixed with some yellow pine, and in low and sandy spots also scrub pine. In very moist places, immediately at the foot of ridges or vertical precipices, where deep beds of mold accumulate, the hemlock spruce (*Abies Canadensis*) reaches 160 feet, and probably over, and a diameter of six feet. Prostrate and decaying trunks are completely wrapped up in mosses, liverworts, and lichens, for which this region is a selected homestead. Embedded in the soft pillows of moss, some delicate, shade-loving plants enjoy a well-protected and concealed existence—the mountain bluet (*Houstonia serpyllifolia*), the frail and subtle *Circaea alpina*, the Canada and downy yellow violet (*Viola Canadensis* and *Viola pubescens*), and the span-high *Mitella diphylla*, or miter wort, with a spike of white flowers, followed by miter-shaped seed capsules. The wood sorrel (*Oxalis Acetosella*), and the low-creeping partridge berry nestle close and snug in cushions of sphagnum, hypnum, and climacium. Above Mundie Bluff a granitoid, heavy bedded rock sets in. It is of grayish color, hard, and but little prone to weathering (*Grauwake*). A thin crust of soil which has formed upon it supports a grayish-green club moss (*Selaginella tortipila*), a low and diffusely-branched willow grass (*Draba ramosissima*), the shrubby St. John'swort (*Hypericum Buckleyi*). Where the débris has accumulated, and water trickles down from the overhanging cliffs, there nod the golden panicles of the *Lysimachia Fraseri*, and the climbing shrub *Decumaria barbara* drapes the walls.

#### THE BIG FROG MOUNTAIN.

A short distance up the road, the river must again be forded to reach some secluded mountain homes called "Beyers Settlement," from whence the ascent of the mountain is most direct and easiest. I made the ascent in July, 1878, in company with some young friends and a guide. At an elevation of about 2,000 feet, with the Big Frog mountain right before us, we started at four o'clock in the evening, prepared to camp out at least one night. The entire party was on foot, a mule carrying the package. A somewhat level place, about two-thirds up the mountain, called the "Sugar Orchard," from the sugar maples which cover this place, was chosen for the camping place, and early in the morning we accomplished the ascent.

At this altitude, from camp to summit, from 3,500 to near 5,000 feet, the reduction of mean temperature corresponds about with the mean temperature of the latitude of Northern Ohio, a difference of eight degrees of latitude. Various shrubs and herbaceous plants, which are indigenous to the latter region, and do not now inhabit the intervening territory, luxuriate in this cool and cloud-enveloped zone. The glory of the prairies has passed away in the Middle and Northern States, but their untainted splendor survives here in these untrodden mountain meadows, although very limited in extent. Trees become scarce and more scattered, with great bald spaces between, with very low trunks in proportion to size of limb and crown. The chestnuts ramify so close to the ground that the lower limbs can be grasped with the hand. The varieties on the summit are chestnut, red oak, yellow birch, mountain maple (*Acer spicatum*), mountain ash (*Pyrus Americana*), white and red cherry (*Prunus Pennsylvanica*), and chock cherry (*Prunus Virginiana*). Of shrubs, we find the round-leaved currant (*Ribes rotundifolium*), two or three species of blueberries (*Vaccinium hirsutum* and *Pennsylvanicum*), the creeping wintergreen (*Gaultheria procumbens*), arborescent azalea (*Azalea arborescens*), *Stuartia* (*Stuartia pentagyna*), and two species of holly (*Ilex monticola* and *Ilex mollis*), and a low, grayish willow (*Salix humilis*).

The gems of this great conservatory, however, are the herbaceous plants, which thrive here with unusual vigor. The Carolina lily, with stems seven feet high, surrounded by a pyramidal raceme of deep orange and black-spotted blossoms, often as many as twenty-five, is very abundant; likewise the *Melanthium Virginicum*, five to six feet high, with hundreds of small, star-shaped, cream-colored flowers in an immense spreading panicle; the *Stenanthium augustifolium*, also a liliaceous plant, resembling the former, flowers greenish white, in a tall raceme; the purple flowering raspberry (*Rubus odoratus*), with simple five-lobed leaves and corymbs of large, showy, purple blossoms, the whole plant very fragrant and clammy. The cow parsnip (*Heraclium lanatum*) spreads its large and woolly leaves broadly over the ground, and lifts its flat umbels above a man's head. White and yellow Baptisias and the Oswego tea (*Monarda didyma*) contribute freely to this unsurpassable display. The blue joint grass (*Calamagrostis Canadensis*) and the *Muhlenbergia Willdenovii* are the principal grasses, both tall and

slender. A pleasantly odorous fern (*Dicksonia punctilobula*) and *Aspidium spinulosum* cover moist depressions of the ground.

#### SMOKY MOUNTAINS.

A type of flora somewhat different from this from the admixture of truly Alpine or high Northern plant forms crowns the still loftier summits of the Smoky Mountains and the Roane Mountain. The mountain defiles and coves on Doe River and Watauga River are traversed by a narrow-gauge railroad, which presently terminates at the Cranberry Iron Works, and a stage road leads up to Cloud-land, a mountain resort on the summit of Roane Mountain, at an altitude of 6,600 feet. Yellow and white pine, and also the table-mountain pine (*Pinus pungens*) predominate on the mountain sides; but white oak, chestnut, cherry, sugar maple, and also walnut and hickories, strong and densely grown, hold the lower grounds and river banks. In these moist and shady gorges abounds the *Dicentra eximia*, a beautiful plant. It is a variety of the bleeding heart, a well-known garden ornament. The *Adlumia cirrhosa*, or climbing fumitory, a very graceful plant, also frequently cultivated in gardens, yet common in Northern New York and the Western States, accompanies the former. A peculiar and very rare shrub, not known elsewhere, the *Buckleya distichophylla*, and the oilnut (*Pyrularia oleifera*), the beaked hazelnut (*Corylus rostrata*), the scrub oak (*Quercus ilicifolia*), and other shrubs which are also common in the Ocoee region form the undergrowth. The smooth-leaved Dutchman's pipe (*Aristolochia Sipho*), the climbing bitter-sweet (*Celastrus scandens*), two species of *Lonicera*, and the bush honeysuckle (*Diervilla sessilifolia*) are lovely and odd-shaped climbers or bushes. *Magnolia Fraseri* abounds here. It is beyond the scope of this sketch to enumerate the species for which the high summits are famous among botanists. The discovery of the sand myrtle (*Leiophyllum buxifolium*), a native of the sandy pine barrens of New Jersey, on the summit of Roane Mountain, is a curious incident in plant geography. *Rhododendron Catawbiense*, several *Saxifragas* and *Solidago glommerta*, *monticola*, *spithamea*, the *Diphylleia cymosa*, *Chelone Lyoni*, *Cardamine Clematitis*, *Paronychia argyrocoma*, *Sedum Rhodiola*, *Geum radiatum*, *Geum geniculatum*, *Boykinia aconitifolia* may serve as examples of rare plants.

Another range of mountain flora we find in the Cumberland

Mountains. Selecting the Lookout near Chattanooga for a type, we find its summit wooded with *Quercus Prinus*, *Quercus rubra*, *Quercus alba*, *Quercus obtusiloba*, and *Quercus nigra*; *Pinus inops*, *Pinus Tæda*, *Pinus mitis*; *Betula lutea*, *Gleditschia*, *triacanthos*, *Robinia Pseudacacia*, several *Caryas* and *C. microcarpa* among them. Of shrubs: *Robinia hispida*, *Diervilla rivularis*, *Ilex mollis*, *Stuartia pentagyna*, *Hydrangea radiata*, and again (but very rare) *Buckleya distichophylla*, *Nemopantes Canadensis*, and in a swamp *Dirca palustris*. Of herbaceous plants: *Utricularia gibba*, *Iuncus Canadensis*, and *Arundinaria tecta*. On flat rocks: *Diamorpha pusilla*, *Fimbristylis capillaris*, *Krigia Virginica*, *Arenaria glabra*. On the cliffs of the crest: *Stipa avenacea*, *Silene rotundifolia*, *Linaria Canadensis*, *Campanula divaricata*, *Thalictrum clavatum*. Near the base of the mountain, on limestone ledges: *Gatesia lactevirens*, *Callicarpa Americana*, *Triosteum perfoliatum*, *Silphium brachiatum*. The Cumberlands excel the Alleghanies in a greater variety of ferns. Besides all species of the latter, we also find here *Asplenium Bradleyi*, *Asplenium pinnatifidum*, *Lygodium palmatum*, *Scolopendrium vulgare*, and *Trichomanes radicans*, *Asplenium viride*, *Adiantum capillus Veneris*.

## MIDDLE TENNESSEE.

The next division embraces the valley of East Tennessee and the entire area of Middle Tennessee. Contour of surface and geological structure result in East Tennessee from the combined processes of folding and erosion, whereby heterogeneous strata are placed in juxtaposition, the whole valley being an often-repeated series of synclinals and anticlinals of calcareous and siliceous rocks, while in Middle Tennessee erosion alone had been at play.

A great fault connected with the upheaval of the Pine and Grab Orchard Mountains, and in a line south of it, an eroded anticlinal, the Sequatchie Valley, designate in the Cumberland Mountain region the western terminus of those convulsions which involve the problem of the stratigraphy of the Alleghanies in so great difficulties. West of this line spread out the horizontal strata of the Cumberland table-land, which terminates with an abrupt descent of about 1,000 feet upon the highlands of Middle Tennessee. These in turn overreach and encircle the floor of the basin of Middle Tennessee by from 500 to 600 feet, either in a bluff or through a gradual descent.

The succession of strata is normal throughout: Uppermost subcarboniferous limestone and chert, followed by the Devonian shale; lastly, the lower Silurian.

Irregular basins, crossed and intersected by ridges of from 400 to 600 feet elevation, and this lower terrace again girded by a plateau, is the outline of Middle Tennessee. This shape of surface is the effect of unequal erosion through differently constituted strata. This agency has been in bygone epochs, probably during the Champlain, much more energetically at work than at the present day. Some superficial gravel beds and the iron ores in the western part of Middle Tennessee have probably been deposited at this period. The floor of this denudation lies either in the Nashville (Hudson) or Trenton limestone, while the hilltops are Devonian or subcarboniferous shales or chert, sometimes sandstones. The limestones produce the strongly calcareous, very productive soil of the lower grounds. The disintegration of the Devonian shales resulted into strata of heavy, impermeable beds of clay or loams, and the concomitant swampy lands and the cherty and siliceous beds have yielded the angular gravels of the poor hilltops. The difference of elevation is so slight that it cannot essentially affect vegetation, and the greater or less adaptation only of plants to certain soils causes their appearance or disappearance at the limits of particular geological areas. The phosphatic rocks belong to this group.

Alluvium is restricted to river and creek bottoms. The heavy and fertile clay soils of the uplands are the insoluble residuum of the fossiliferous, argillaceous limestones, with more or less complete lixiviation of the lime by atmospheric precipitations. In the midst of these is a third class of soil, of black color, full of bog iron ore in the shape of rounded grains. Sulphurated ferruginous springs, decomposition of pyritical limestones, accompanied by perennial growth of cane, have, as it seems, generated it.

Increase in annual range of temperature and greater dryness of air, as compared with the former regions, cause the mountain flora to disappear and to yield to other designs in nature's garb. A close botanical inquiry into the array of species soon discloses the fact that different assemblies of species congregate in the limestone and argillaceous-siliceous region. The former includes the glades; the latter, the barrens, of Middle Tennessee.

Glades are thinly-wooded, unarable lands, with shallow soils, fit only for pastures. They ought to remain in their natural state,

undisturbed by cultivation. To clear them is to convert them into deserts. In some parts they are exclusively occupied by the cedar, with a small percentage of deciduous trees intermingled.

Trees distinguishing this ground and region are the overcup oak (*Quercus lyrata*), bur oak (*Quercus macrocarpa*), in moist soils; the water Spanish oak (*Quercus Texana*), in wet lands. The former two are the largest of our oaks. The yellow chestnut oak (*Quercus Muhlenbergii*) grows in wet and dry soil. The shingle oak (*Quercus imbricaria*), with undivided lanceolate leaves, like the willow, makes a large, well-shaped, and very ornamental tree. White oaks, post oaks, black oaks, and red oaks are equally disseminated. Elms, very large and numerous, add four species. Two varieties of shellbark hickory belong to rich bottoms, and mocker-nut and pignut hickory to the hills. The pecan nut (*Carya olivæformis*) occurs here and there in single old trees, probably planted by early settlers. Black walnut (*Juglans nigra*) has formerly been copious; white walnut is scattered along the river and creek banks and swamps. The Ohio buckeye abounds on the north side of Cumberland River. In Hadley's Bend, near Edgefield Junction, are groves of holly with 20-inch diameter of trunk. Catalpas are rare, but the yellow wood (*Virgilia lutea*) and the coffee tree (*Gymnocladus Canadensis*) are very numerous on the rich hillsides south of Nashville. Altogether, we have about one hundred different kinds of timber in the immediate vicinity of Nashville.

The climbing form of growth is an eminently Southern type, loving rich soils and moisture, addicted to the forest which it is destined to embellish. Multiform ligneous and herbaceous climbers, stragglers, and creepers tangle and barricade the woodlands. Five different grapevines fill the air in May with the sweet fragrance of their flowers—the summer grape (*Vitis æstivalis*) on dry or rocky ground; the winter grape (*Vitis cordifolia*) on rich and moist lands, especially river banks. A variety of this with lobed leaves (*Vitis riparia*) grows copiously on Mill Creek. The rock grape (*Vitis rupestris*), on rocky bluffs, is a Western species, not discovered before east of the Mississippi. All these bear edible fruit, and are serviceable for root grafting with imported varieties, such vines being more resistant to the aggression of the root phylloxera. Two species with inedible fruit (*Vitis indivisa* and *Vitis bipinnata*) may also be mentioned. The woolly-leaved Dutchman's pipe (*Aristolochia tomentosa*), the wistaria, the bignonia, and the trumpet

flower bear beautiful or curiously-shaped flowers, but the unsightly smilax threatens with his thorns the vexed explorer.

Several plants held for exclusively Western have lately been observed around Nashville. The *Solanum rostratum*—from the tribe of the Irish potato—with golden flowers, foliage like the watermelon, elegant looking, but unapproachable from the prickles and thorns with which it is beset all over, is such an intruder, and a very undesirable one, being an inextinguishable, all-spreading weed; *Oenothera triloba*, a dwarfish evening primrose, not more than a span high, with large yellow flower, a common plant on the plains; and some other less conspicuous weeds. Where the soil thins out, leaving here and there the rock exposed, or where from the collapse of subterranean cavities the strata are tumbled about in confusion and earth and humus irregularly distributed, there the heavier timber growth gives out, and the cedar is the predominant growth. Its far-searching roots descend into the crevices and cavities of the age-worn rock. The somber tint of the cedar delineates a cedar barren from its surroundings at a distance, and serves within its environs to bring out with dazzling vividness the beautiful green of the glade grass, aglow with rose-colored petalostemons, sky-blue lobelias, golden Leavenworthias, Schoenoliriums and shrubby hypericums. The pink stonecrop, *Sedum pulchellum*, covers acres of surface, yielding again to equal profusion of the delicate white Arenaria (*Arenaria patula*), or a low, purple-flowered skullcap (*Scutellaria nerrosa*). The *Talinum teretifolium*, span high, with fleshy leaves like a portulaca, the flower resembling the bloom of a phlox, but of the purest carmine, finds room for its tuberous rootlets in the smallest fissures. It will bear transplanting even while flowering, and grows well in the garden. Cream-colored and blue astragals (*Astragalus Plattensis* and *Astragalus caryocarpus*), and a purple, large-flowered, and prostrate psoralea (*Psoralea subcaulis*), phacelias, the blue false indigo (*Baptisia australis*), bluets, and the Carolina anemone (*Houstonia patens*, *Anemone Caroliniana*), verbenas, violets (especially the pansylike *Viola pedata* var. *bicolor*), the dwarf heliotrope (*Heliotropium tenellum*), the pale purple *Phlox Stellaria* (which deserves a bed in every garden), and many, many more assemble—a natural conservatory that could fearlessly challenge any flower garden in the combined effect of gayety and luxuriance. For truth, my honored Tennessee friends, go and see, and learn to appreciate and to preserve such

great ornaments of your native land. I cannot dwell longer on this point; suffice it to say that the above are only a few of the most obvious spring flowers, and that every succeeding season has its own peculiar growth. The hop tree (*Ptelea trifoliata*), fragrant sumac (*Rhus aromatica*), Carolina buckthorn (*Frangula Caroliniana*), *Forestiera ligustrina*, delightfully fragrant when flowering in July, the *Callicarpa*, with clusters of rosy flowers and violet berries, and several kinds of hawthorn, are the characteristic shrubs of these barrens. Hackberry, honey locust, winged elm, post oak and shingle oak intermingle in limited numbers with the cedar.

The siliceous and argillaceous soils which surround the Silurian formation correspond to the cherty strata of the subcarboniferous and the blue or black shales of the Devonian formation. The former is commonly called "gravelly hills," and supports a meager and monotonous vegetation. Black-jack oak, Spanish oak, red oak, and black oak are prevailing, especially the former two. Post oak and white oak attain only medium size. Chestnut, sourwood, mockernut and pignut hickory are the principal trees. The shrubbery is represented by the farkleberry (*Vaccinium arboreum*), deerberry (*Vaccinium stamineum*), black huckleberry (*Gaylussacia resinosa*), Kalmias, purple azalea, chinquapin chestnut (*Castanea pumila*), New Jersey tea (*Ceanothus Americanus*) and an immense amount of dwarf sumac (*Rhus copallina*), Lespedezas and Desmodimus, and later in the season several species of *Coreopsis* and *Solidago*. The common brake (*Pteris aquilina*) and the beech fern (*Phegopteris hexagonoptera*) grow abundantly. The sandy, loamy, or argillaceous soils of the shale contain some valuable farming lands, but a good deal of it is either too light or too wet. The underlying slate seems to form impermeable strata, and in winter and spring large tracts of land are covered with shallow ponds, which disappear only from evaporation in the summer and autumn. These strata underlie the Oak Barrens (Tullahoma). The vegetation is diversified and very interesting. The forest contains a good selection of hardwoods, and the trees attain a very good size. Water oak, willow oak, and white oak grow very large; sweet gum and black gum, in abundance; poplars and beeches, not as many as in the calcareous soils; cedars, only solitary and rare; pines and firs, none at all. There are neither pines nor firs the whole length of distance from Pulaski to Elizabethtown, near Louisville, Ky., nor are any found for a great distance east or west

of this line (Nashville and Decatur Railroad). The scrub pine is the only species I ever observed in Middle Tennessee. I found it sparingly and confined to a limited belt in the hills around the confluence of the Harpeth and Turnbull Rivers, in Dickson County.

Shrubs which are especially addicted to the Oak Barrens are the large-flowering hydrangea (*Hydrangea radiata*, at the Cataract, in Tullahoma), Itea, with small white flowers in drooping racemes; calycanthus, or Carolina allspice; service berry (*Amelanchier Canadensis*), the narrow-leaved crabapple (*Pyrus angustifolia*), hazelnut (*Corylus Americana*), and in wet lands the button bush (*Cephalanthus occidentalis*), chokeberry (*Pyrus arbutifolia*), arrowwood (*Viburnum nudum*), Southern buckthorn (*Bumelia lycioides*), smooth alder (*Alnus serrulata*), dwarf gray willow (*Salix tristis*). The moist woodlands and swamps abound in showy orchids, liliaceae, and aquatic plants. Three species of flags (*Iris versicolor*, *Iris Virginica*, *Iris cristata*), Turk's cap lily (*Lilium superbum*), blackberry lily (*Pardanthus chinensis*), *Zygadenus limanthoides*, narrow-leaved false hellebore (*Stenanthium angustifolium*), fly poison (*Amianthium muscaetoxicum*). Several species of orchids: Habenaria, Pogonia, Corallorrhiza, Calopogon, and Cypripedium: various Sabbathias, a host of Pycnanthemums, Asters, Gerardias, Helianthus, button snake roots (*Liatris squarrosa*, *Liatris graminifolia*), and some very elegant grasses, the woolly beardgrass (*Erianthus alopecurioides*, *Erianthus brevibarbis*, and *Erianthus strictus*), Indian grass (*Sorghum nutans*), wood reedgrass (*Cinna arundinacea*). Among ferns we find a stately growth of Osmundas, especially the *Osmunda regalis* and Claytoniana, attaining three to five feet; the chain fern (*Woodwardia angustifolia*), *Aspidium Goldieanum*, also becoming sometimes four feet high; sensitive fern (*Onoclea sensibilis*). Rushes, sages, and grasses present themselves in interminable succession to the well-trained botanist who understands how to distinguish them.

#### WEST TENNESSEE.

The Tennessee River very nearly indicates in its northern course a geological division, flowing, as it does, along an ancient Devonian and Silurian shore line. A few miles west and parallel with the river rises the eastern escarpment of an undulating plateau of from only 200 to 300 feet elevation above the waters of the Tennessee River. This irregular table-land slopes gradually toward

the Mississippi River and terminates there in another bluff, which rises about 200 feet over the floods of the Mississippi. The eastern portion of this area is composed of cretaceous deposits, and the western portion is composed of tertiary and post-tertiary deposits, either sands or soft cretaceous shale. Solid, often ferruginous, sandstones appear at the surface, scattered in incoherent masses.

We behold no longer limpid streams, rippling over rocky bottoms, sided by cliffs and bluffs. Instead of them, we find lagoons and swampy borders, stretching along muddy-looking waters of sluggish streams.

From distance already, before crossing the Tennessee River, we are in sight of towering cypresses. While a thousand miles east from here they yet occupy the shore line of the Atlantic, here the shore line has receded to the Gulf and left the cypress behind. Their dimensions are truly enormous. The far-spreading roots emerge like sharp-backed ridges from the brownish lagoon, gradually creeping up and girding with buttresslike projections the many-angled column. A perpendicular shaft ascends to a height of from 120 to 150 feet and then spreads in a flat or hemispherical crown. Such I have seen, in 1864-70, near Johnsonville. Cypress swamps are along both big rivers, and many other extensive swamps and swampy lands are along every water course—the most, perhaps, along Big Sandy. It may, therefore, be expected that a great many more aquatic species and such as inhabit marshy lands exist in this region than in either East or Middle Tennessee. My own experience is, however, limited and restricted to one point on the Mississippi River—the regions of Brownsville, Humboldt, McKenzie, Hollow Rock, and Johnsonville, in which places I have made interesting collections.

In the cypress swamps and boggy lowlands we find the planer tree, or water elm (*Planera aquatica*); the cypress (*Taxodium distichum*), the stateliest of our timber trees; the swamp locust (*Gleditschia monosperma*); the tupelo gums (*Nyssa sylvatica* and *Nyssa aquatica*); the mountain sweet pepper bush (*Clethra acuminata*), so frequent in the mountains of East Tennessee, but rare in Middle and West Tennessee; the swamp white oak (*Quercus bicolor*), the black alder (*Ilex verticillata*), the swamp holly (*Ilex decidua*), intertwined with the climbing bittersweet (*Celastrus scandens*), and the supple-jack (*Berchemia volubilis*). Two buck-thorns (*Rhamnus Caroliniana* and *Rhamnus lanceolata*) are also

very frequent in the bottoms. One of the showiest shrubs of this region, the lately-discovered *Hypericum lobocarpum*, which would make a splendid adornment of every garden, grows copiously around Hollow Rock. It makes a flat-topped bush from six to eight feet high. In the swamps float the water shields (*Brasenia peltata* and *Cabomba Caroliniana*), while the water chinquapin (*Nelumbo lutea*) rears its big, peltate foliage and large, sulphur-yellow flowers high above the brownish waters of the lagoon.

Of other frequent aquatics I may only mention the *Limnanthemum lacunosum*, *Ranunculus multifidus*, *Utricularia biflora*. Species of *Lemna*, *Wolffia*, and the neat *Azolla* cast a green veil over the quiet pools. The Indian rye (*Zizania aquatica*), a tall grass, which the Indians used to harvest, using the grains for meal, is here in its proper sphere, and its tall heads look down upon patches of sword lilies, *Iris cuprea*, and *Iris hexagona*; and all the swampy flats are filled with *Scirpus debilis*, *Carices*, and *Rhynchosporas*.

On higher grounds congregate *Dalea alopecuroides*, *Galium Arkansanum*, *Eryngium prostratum*, *Marshallia lanceolata*, *Ambrosia bidentata*, *Helenium tenuifolium*, *Senecio lobatus*, *Hydrolea affinis*, *Verbena stricta*, *Polypremum procumbens*, *Stillingia sylvatica*, *Lithospermum angustifolium*, *Habenaria virescens*, *Juncus militaris*, *Spartina cynosuroides*, *Aristida ramosissima*.

From the suburbs of Memphis I received the elegant *Erogrostis orylopis*. On the sandy shores of the Mississippi River abounds a species of horsetail, the *Equisetum robustum*, and the invidious burgrass that sticks to clothing and spoils the vlieses of the sheep with its sticky spikes. (*Cenchrus tribuloides*.)

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# Synopsis of the Flora of Tennessee.

Arranged according to the system of Engler and Prantl, in their  
"Naturliche Pflanzenfamilien,"

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1899.

## PTERIDOPHYTA.\*

## OPHIOGLOSSACEÆ Presl.

## OPHIOGLOSSUM L.

1. *Ophioglossum vulgatum* L. Adder's-tongue. In moist spots in the cedar glades at Lavergne, Williamson County. May, June.

## BOTRYCHIUM Sw. Schrad.

1. *Botrychium ternatum* (Thunb) Sw. Moonwort, grape fern. O. S. May, June. *M.*

2. *B. Virginianum* (L) Sw. Rich, moist woods. O. S. May.

3. *B. dissectum* Sprengel. With the former. May, June.

## OSMUNDACEÆ R. Br.

## OSMUNDA L.

1. *Osmunda regalis* L. Royal fern. Bogs and swamps, mountains and lowlands. Frequent. O. S. May, June. *M.*

2. *O. cinnamomea* L. Cinnamon fern. In marshes, high grounds or low grounds. O. S. May-July.

3. *O. Claytoniana* L. Cumberland and Alleghany Mountains. May, June.

## HYMENOPHYLLACEÆ Gaud.

## TRICHOMANES L.

*Trichomanes radicans* Sw. Bristle fern. Underneath wet, shelving rocks. Sewanee. June, July.

## SCHIZAEACEÆ Reichenb.

## LYGODIUM Sw. Schrad.

1. *Lygodium palmatum* (Bernh.) Sw. Climbing fern. Cumberland Mts. Rockwood. Graborchard. Piney Falls, Mrs. Bennett. July, August.

## POLYPODIACEÆ R. Br.

## ONOCLEA L.

1. *Onoclea sensibilis* L. Wet meadows and borders of ponds. O. S. June.

2. *O. sensibilis obtusilobata* Torr. Williamson County. July, August.

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\*Arranged after W. R. Maxon's List of Ferns of North America in Smithsonian Publications, No. 1226, May, 1901.

**WOODSIA** R. Br.

1. *Woodsia ilvenis* R. Br. Knox County. A. Ruth. June, July.

2. *W. obtusa* (Spreng.) Torr. Very common. O. S. July, August.

**DENNSTAEDTIA** Bernh.

*Dennstaedtia punctilobula* (Michx.) Moore. *Dicksonia punctilobula* L'Her. Higher Cumberland and Alleghanies. Piney Falls. Mrs. Bennett. August.

**FILIX** Adans.

*Filix bulbifera* (L.) Underw. *Cystopteris bulbifera* Bernh. Shady cliffs around Nashville, Cumberland Mts. July.

*F. fragilis* (L.) Underw. *Cystopteris fragilis* Bernh. Mountains and lowlands. O. S. May-July.

**POLYSTICHUM** Roth.

*Polystichum acrostichoides* (Michx.) Kuntze. *Dryopteris acrostichoides* Kuntze. Christmas fern. Very common. O. S. June-August.

**DRYOPTERIS** Adans.

*Dryopteris Novæboracensis* A. Gray. Moist grounds in the oak barrens of M. Tenn. Tullahoma. July-September.

*D. thelypteris* (L.) Asa Gray. Knoxville, L. F. Scribner. June, July.

*D. Goldieana* (Hook.) A. Gray. *Aspidium Goldieanum* Hook. Cumberland and Alleghany Mts. Frequent. July, August.

*D. marginalis* (L.) A. Gray. *Aspidium marginale* Sw. Over the Cumberland and Alleghany Mts. Leaves evergreen. July, August. *M.*

*D. spinulosa* (Retz.) Kuntze. Smoky Mts.

*D. spinulosa intermedia* (Mühl.) Underwood. Wolf Creek. Cocke County, Clingman's Dome. July.

*D. spinulosa dilatata* (Hoffm.) Underw. With the former. July, August.

**PHEGOPTERIS** Fée.

*Phegopteris Phegopteris* (L.) Underw. Beech fern. *Phegopteris polypodioides* Fée. Mts. of East Tennessee.

*Ph. hexagonoptera* (Michx.) Fée. Highlands of Middle Tennessee. Frequent; leaves, fragrant. August.

**WOODWARDIA** J. E. Smith.

*Woodwardia areolata* (L.) Moore. *Woodwardia angustifolia* J. E. Smith. Chain fern. Bogs. O. S. July, August.

**PHYLLITIS** Ludwig.

*Phyllitis Scolopendrium* (L.) Newm. Hart's tongue. *Scolopendrium vulgare* J. E. Smith. Near South Pittsburg, Cumberland Mts. R. M. Middleton, Jr. June-August.

**CAMPTOSORUS** Link.

*Camptosorus rhizophyllus* (L.) Link. Walking fern; common. O. S. June-August.

**ASPLENIUM** L.

*Asplenium pinnatifidum* Nutt. Cumberland plateau and Lookout Mountain. May-July.

*A. viride* Huds. Bluffs near South Pittsburg. R. M. Middleton, Junior.

*A. parvulum* Mart and Gal. On limestone rocks. O. S. June-October.

*A. platyneuron* (L.) Oakes. *Asplenium ebeneum* Ait. On limestone rocks; common. O. S. July-September.

*A. Trichomanes* L. On schists and siliceous rocks. Chilhowee and Cumberland Mts. June-August.

*A. angustifolium* Michx. Rich, damp woodlands. O. S. July, August.

*A. Ruta-muraria* L. On limestone and siliceous rocks in the valleys and in the mountains. July, August.

*A. montanum* Willd. Cumberland and Alleghany Mts. June-August.

*A. Bradleyi* DC. Eaton. On sandstone rocks, summit of Lookout Mountain; also Sewanee, E. Kirby Smith; Sequatchee Valley, Middleton. June-August.

**ATHYRIUM** Roth. O. C.

*Athyrium acrostichoides* Desv. *Athyrium thelypteroides* Michx. Highlands of Middle Tennessee.

*A. Filix-foemina* (L.) Bernh. Lady fern; common. O. S. *M.*

*A. Filix-foemina angustum* Willd. Bogs at Hollow Rock, West Tennessee.

**ADIANTUM** L.

*Adiantum Capillus-Veneris* L. Venus hair fern. Cumberland Mts., near South Pittsburg, four miles from furnace, J. E. Wall, Jr.; also near South Pittsburg, with fronds two feet in length, by R. M. Middleton, Jr. May, June. *M.*

*A. pedatum* L. Maiden hair fern. Rich, moist woods. O. S. May-July. *M.*

**PTERIDIUM** Scop.

*Pteridium aquilinum* (L.) Kuhn. Bracken fern. The larger form in rich, moist woods. Cumberland and Alleghany Mts.

*Pt. aquilinum pseudocaudatum* (L.) Clute. A form common in siliceous soils, and gravelly hill lands. O. S. July-September.

**PELLÆA** Link.

*Pellaea atropurpurea* (L.) Link. Cliff brake. On exposed situations on limestone banks and cliffs. O. S. June-September.

**CHEILANTHES** Sw.

*Cheilanthes Alabamensis* (Buckl.) Kuntze. Limestone rocks; frequent in E. and M. Tenn. July-September.

*Ch. lanosa* Michx. *Ch. vestita* (Sw.) Watt. Bluffs on Cumberland River, cedar glades under cedars, Mts. of East Tennessee. June-September.

*Ch. tomentosa* Link. Bluffs on Ocoee River. Fronds often 2 feet long. Also South Pittsburg. Cumberland Mts.

**POLYPODIUM** L.

*Polypodium vulgare* L. On rocks and on the ground, Cumberland and Alleghany Mts. Summer. *M.*

*P. polypodioides* (L.) A. S. Hitchcock. *P. incanum* Sw. Covering trunks of trees, on rocks, and on the ground. O. S. June-October.

**SALVINIACEÆ** Reichenb.**AZOLLA** Lam.

*Azolla Caroliniana* Willd. On a weir or millpond, near Riceville, McMinn County, and W. Tenn. cypress swamps. July.

**EQUISETACEÆ** Michx.**EQUISETUM** L.

*Equisetum arvense* L. Field horsetail. Moist fields, Cave Spring, E. Tenn.

*E. robustum* A. Br. Sandy banks of Mississippi River, W. Tenn.

*E. hyemale* L. Common scouring rush. Along Holston River. J. K. Small.

**LYCOPODIACEÆ** Michx.**LYCOPODIUM** L. Club Moss.

*Lycopodium Selago* L. Roane Mt. T. W. Chickering.

*L. lucidulum* Michx. Sewanee. Rugbee. Mrs. M. S. Percival.

**L. obscurum** L. Ground pine. *Lycopodium dendroideum* Michx. Wolf Creek, Cocke County. Cranberry, on Doe River. Cumberland Mts.

**L. complanatum** L. Trailing Christmas-green. Over the Cumberland Mts.

#### SELAGINELLACEÆ Underw.

##### SELAGINELLA Beauv.

**Selaginella tortipila** R. Br. Dry rocks in Ocoee Valley. July-October.

**S. apus** Sprengel. Moist, shaded grounds; often among the grass. O. S. June-September.

**S. rupestris** (L) Spreng. Dry rocks and gravelly hills. O. S.

#### ISOETACEÆ Underw.

##### ISOETES L.

\***Isoetes Butleri immaculata** Engelm. Cedar glades near Lavergne. West Nashville ("New Town"), near Nashville, in miry grass plots.

## SPERMATOPHYTA.

### GYMNOSPERMÆ.

#### PINACEÆ Lindl.

##### PINUS L.

**Pinus Strobus** L. White pine. Cumberland Mts. and prominently the Alleghanies along the slopes of the highest ridges, where it frequently constitutes two-thirds of the status of the forest over extensive areas, reaching an altitude of from 100 to 175 feet. It is a very clean and graceful tree. May. *M.*

**P. Virginiana** Miller. *P. inops* Ait. Scrub pine. Rocky, dry mountain slopes. O. S. April, May.

**P. echinata** Miller. Yellow pine. Spruce pine. *P. mitis* Michx. Formerly abundant, clading the lower ridges of the valley of East Tennessee; presently much reduced in numbers. May, June.

**P. pungens** Michx. f. Table mountain pine. Frequent in the Smoky Mt. range. Altitude from 40 to 80 feet. May.

**P. rigida** Mill. Pitch pine. With the former, and of about the same size. May.

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\*Dioecious, with a subglobose trunk, bright green, rather firm leaf, sometimes as many as 60, 6 to 9 inches long; sporangium, without spots; macrospores, 0.40-0.56 mm. diameter; microspores, 0.029-0.031 mm. long, spinulose.

**P. Taeda** L. Loblolly pine. Old field pine. This pine is the most frequent in the southeast corner of the State, along Conasauga Creek, extending down into Georgia. A large tree reaches in favorable ground to a height of 150 feet. April, May.

#### PICEA Link.

**Picea Mariana** (Mill.) B. S. T. *Abies nigra* Ait. Black spruce. Highest points of the Smokies. On White Top Mountain. Southwest Virginia. J. K. Small. May, June.

**P. rubra** Link. Red spruce. With the former. Both are slender trees. May.

#### TSUGA Carr.

**Tsuga Canadensis** (L.) Carr. Hemlock. Along water courses Cumberland and Alleghany Mts. One of our largest forest trees, attaining a height of from 150 to 180 feet by from 6 to 7 feet diameter. April. *M.*

**T. Caroliniana** Engelm. *Abies Caroliniana* Chapm. Does not grow to the sublime height of the former, scarcely exceeding 50 or 75 feet. High mountains on the border of North Carolina. April.

#### ABIES Juss.

**Abies Fraseri** (Pursh.) Lindl. *Pinus Fraseri* Balsame Fir. Smoky Mts. Summit of Roane Mt. J. W. Chickering. May, June.

#### TAXODIUM (L.) C. Rich.

**Taxodium distichum** (L.) L. C. Rich. Cypress. The largest conifer in the Eastern United States. Along Tennessee River and Mississippi River in West Tennessee and their affluents, in the bayous and cypress swamps, it attains an altitude of perhaps 200 feet by 12 feet diameter near the ground. The extensive railroad trussels and bridges in West Tennessee have been built from it. The wood stands exposure to wet and atmosphere better than any other soft-wood timber. May, June.

#### THUJA L.

**Thuja occidentalis** L. White cedar. Along Holston River in the mountains of E. Tenn. A. Ruth.

#### JUNIPERUS L.

**Juniperus Virginiana** L. Red cedar. Scattering O. S. Forming forests of nearly exclusive cedar growth in the basin of M. Tenn. Cedar glades, with a diversified and peculiar flora. April, May. Fruit matures in September and October.

## TAXACEÆ Lindl.

## TAXUS L.

*Taxus minor* (Michx.) Britton. American Yew. *Taxus baccata* var. *minor* Michx. Waters of Holston River. J. K. Small.

## CLASS 2. ANGIOSPERMAE

## SUBCLASS 1. MONOCOTYLEDONES.

## TYPHACEÆ J. St. Hil.

## TYPHA L.

*Typha latifolia* L. Cat tail. In marshes. O. S. June, July.

*T. angustifolia* L. Apparently rare. Ducktown, Polk County, near Kingston Springs. In ponds and ditches. June, July.

## SPARGANIACEÆ Agardh.

## SPARGANIUM L.

*Sparganium eurycarpum* Engelm. Cleveland, E. Tenn.; Tullahoma; Nashville. May.

*S. androcladum* (Engelm.) Morong. *S. simplex* var. *Nuttallii* A. Gray. O. S. One-mile pond, Nashville, July.

## NAIADEÆ Lindl.

## POTAMOGETON L.

*Potamogeton natans* L. Floating pond weed. Wolf River, W. Tenn. Dr. Egeling.

*P. perfoliatus* L. Wolf River, Memphis. Dr. Egeling.

*P. pusillus* L. Wolf Creek. Cocke County.

*P. Spirillus* Tuckerm. Pond at new bridge, Nashville. August.

*P. diversifolius* Raf. *P. hybridus* Michx. Cumberland River, Nashville; Tullahoma Creek, Tullahoma. July-September.

*P. foliosus* Raf. *P. pauciflorus* Pursh. O. S. June-August.

*P. Nuttallii* Cham. and Sch. *P. Claytonii* Tuckerm. Mountain streams of E. Tenn. June-August.

## ZANNICHELIA L.

*Zannichelia palustris* L. In ponds and springs. O. S. June-August.

## ALISMACEÆ D. C.

## ALISMA L.

*Alisma Plantago-aquatica* L. In shallow water. O. S. June-September.

## ECHINODORUS Rich. Engelm.

*Echinodorus radicans* Engelm. Swamps along Cumberland River. July.

## SAGITTARIA L.

*Sagittaria latifolia* Willd. Broad-leaved arrow head. Ponds and shallow waters. O. S. August-September.

*S. latifolia pubescens* Michx. East Tennessee.

*S. latifolia angustifolia* Engelm. Hollow Rock, West Tennessee.

*S. graminea* Michx. West Tennessee.

## VALISNERIACEÆ Dumort.

## PHILOTRIA Raf.

*Philotria Canadensis* (Michx.) Britton. *Elodea Canadensis* Michx. (*Anacharis Canadensis* Planch.). Stagnant waters. O. S. May-August.

## GRAMINEÆ Juss.

## MAYIDEÆ.

## ZEA L.

*Zea Mays* L. Indian corn. Cultivated in many varieties, it constitutes the most important field crop in the State. Sometimes it is self-sown at the roadside, but it does not attain any growth without cultivation. *M.*

## TRIPSACUM L.

*Tripsacum dactyloides* L. Gama grass. In moist pastures near Hickman. A large patch in the old graveyard in Nashville. June-September.

## ANDROPOGONACEÆ.

## ERIANTHUS Michx.

*Erianthus alopecuroides* (L.) Ell. Plum grass. Old fields, Dickson County. Tullahoma. September, October.

*E. strictus* Baldw. Tullahoma. Swamps near Jackson. S. M. Bain.

*E. brevisbarbis* Michx. Mitchellville, Sumner County.

*E. contortus* Ell. Hiwassee Valley. A. Ruth. E. Smallii  
C. V. Nash.

*E. Ravennæ* Beauv. Frequently cultivated, maturing seeds  
and spreading outside of cultivation. July.

### ANDROPOGON L.

*Andropogon scoparius* Michx. Broom grass. Old fields.  
O. S. August-October.

*A. scoparius multirameus* Haekel. Banks of Cumberland  
River.

*A. argyreus* Schult. Ocoee Valley. Vicinity of Knoxville.  
Scribner.

*A. furcatus* Mühl. *A. provincialis* Lam. O. S. August,  
September.

*A. Virginianus* L. *A. dissitiflorus* Michx. O. S. August,  
September.

*A. Virginicus vaginatus* Chapm. With the former.

*A. Elliottii* Chapm. *A. clandestinus* Hale. Occurs in two  
forms promiscuously near Tullahoma: var. *genuina* and var.  
*gracilis* Hack. September, October.

*A. glomeratus* (Walt.) b. s. p. a. *macrourus* Michx. Sandy  
soils. O. S. October.

### CHRYSOPOGON Trin.

*Chrysopogon avenaceus* Michx. Wild oat grass. O. S.  
Old fields.

*Ch. nutans* (L.) Bentham. Old, sandy fields. Dickson  
County; Knoxville, on dry hills. Scribner.

### SORGHUM Pers.

*Sorghum Halepense* (L.) Pers. Johnson grass. Old fields  
and waste grounds. O. S. July-September. Introduced for  
forage, but frequently abandoned as unsuitable for regular  
cultivation and inferior in nutritive qualities.

*S. saccharatum* Pers. Chinese sugar cane. Largely culti-  
vated for production of molasses.

*S. saccharatum* (var.) *technicum* Haeckl. Broom corn.  
Cultivated for the manufacture of brooms.

*S. vulgare*. Pers. Chicken corn. Occasionally cultivated  
for poultry feed.

### PANICEÆ.

### PASPALUM L.

*Paspalum mucronatum* Mühl. *P. fluitans* Smith. Slow  
streams, floating. July-September. O. S.

*Paspalum membranaceum* Walt. *P. Walterianum* Schult. Moist and miry soils, along Cumberland River, and in the barrens. September.

*P. distichum* L. Joint grass. Low grounds, margin of points. O. S. August, September.

*P. dilatatum* Poir. Memphis. August, September.

*P. platycaule* Poir. *P. compressum* Nees. Cultivated at the Knoxville Experiment Station. Scribner.

*P. pubiflorum glabrum* Vasey. Vicinity of Nashville, Belle Meade. Scribner. Lake County, near Mississippi River. S. M. Bain. June-August.

*P. Boscianum* Flugge. *P. purpurascens* Ell. Knoxville. L. F. Scribner. Hiwassee Valley. A. Ruth. September.

*P. Floridanum* Michx. Moist fields, West Tennessee. S. M. Bain. September.

*P. laeve-pilosum* Scrib. With the former.

*P. ciliatifolium* Michx. Common in grass plots. O. S. July-September.

*P. longipedunculatum* Le Conte. Frequent. O. S. July-September.

*P. longipedunculatum debile* Michx. Damp, sandy soil, at the pond. Pond Station, Dickson County. July.

### PANICUM L.

*Panicum Crus-galli* L. Barnyard grass. Barnyards, ponds, and ditches. O. S. August-October.

*P. Crus-galli muticum* Vasey. Streets of Nashville. August, September.

*P. Walteri* Pursh. *P. Crus-galli hispidum* Torr. Very common O. S. in water and in barnyards. September.

*P. colonum* L. Miry places along Cumberland River. Lavergne. September.

*P. gibbum* Ell. Madison County. S. M. Bain. E. Tenn. A. Ruth.

*P. hians* Ell. *P. melicarium* Michx. Memphis. Dr. Egeling.

*P. rostratum* Mühl. *P. anceps* Michx. Moist places in the cedar glades, Lavergne. July.

*P. agrostidiforme* Lam. *P. agrostoides* Trin. Wet ground. O. S. September.

*P. elongatum* Pursh. *P. agrostoides* Mühl. Ditches and ponds. O. S. July-September.

*P. virgatum* L. Islands in Cumberland River. Sandy soil in the barrens at Tullahoma. July-September.

*P. sphærocarpum* Ell. Cedar glades. The earliest of all our Panicums. May.

*P. microcarpon* Mühl. *P. multiflorum* Ell. In moist and rich soils, Craggy Hope, Cheatham County. Ocoee Valley. June, July.

*P. Porterianum* Nash. *P. latifolium* Walt. O. S. Appears early. May, June.

*P. commutatum* Schult. *P. nervosum* Mühl. Hills of M. Tenn. May-July.

*P. Columbianum* Scribn. Fide Illust. Flora. Appendix.

*P. macrocarpon* Le Conte. Dry hillsides on Mill Creek, Nashville. July.

*P. clandestinum* L. Rich soil along river banks. Nashville. July, August.

*P. Scribnerianum* Nash. *P. pauciflorum*. A. Gray. Dry, siliceous grounds. July, August.

*P. laxiflorum* Lam. Highlands, damp, rich woods. July, August.

*P. nitidum* Lam. Siliceous soils, vicinity of Nashville and Knoxville. Scribner.

*P. dichotomum* L. Thickets. O. S. May-July.

*P. barbulatum* Michx. With the former. O. S. June-August.

*P. viscidum* Ell. O. S. Madison County. S. M. Bain. Hiwassee Valley. A. Ruth. June.

*P. scoparium* Lam. (var.) *genuinum*. W. Tenn. S. M. Bain. Cedar glades. July.

*P. scoparium minus* Scribner. Hilltops around Nashville.

*P. depauperatum* Mühl. Dry, siliceous soil. M. Tenn. July.

*P. pubescens* Lam. *P. lanuginosum* Ell. In the cedar glades. June-September.

*P. angustifolium* Ell. *P. consanguineum* S. Watson. Henderson, W. Tenn. S. M. Bain. Knoxville. Scribner.

*P. proliferum* Lam. *P. geniculatum* Mühl. Ditches and ponds. O. S. July-September.

*P. capillare* L. Witch grass. Sandy, cultivated ground. O. S. July-September.

\**P. capillare Gattingeri* Nash. *P. capillare* var. *compestre* Gattinger (in "Tennessee Flora," first edition). Common in the cedar glades. September.

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\**Panicum capillare* L., var. *flexile* Gattinger, is either one of the forms of *P. capillare*, or an annual variety of *P. autumnale* Rascoe, which it resembles greatly, especially in smoothness and form of spikelets. It is very smooth above, with some hairs on the lower part of culm and leaves; culm very slender, panicle rather small, and branches not spreading until the mature spikelets are ready to drop off; leaves linear, gradually attenuate, of a pale green color. It abounds in the cedar glades, and is rarely seen outside of them.

*P. flexile* (Gattinger) Scribner. Cedar glades; very common. July-September. Characteristic of the glades.

*P. minus* (Mühl.) Nash. *P. capillare* var. *minimum* Engelm in litt. Loamy fields, near Rising Sun Bluff, below Nashville.

*P. verrucosum* Mühl. Bogs along Cumberland River. Mitchellville. July.

### SYNTHERISMA Walt. (*Digitaria* Scop.)

*Syntherisma sanguinalis* (L.) Nash. *Digitaria sanguinalis* Scop. Crop grass. Yields a spontaneous crop of hay in corn-fields at the close of the growing season. September, October.

*S. linearis* (Krock.) Nash. (*Panicum glabrum* Gaud.) Pastures and waste grounds. A very valuable pasture grass, maturing later than the former. Middle Tennessee. September, October.

*S. filiformis* (L.) Nash. *Digitaria filiformis* Mühl. *Panicum filiforme* L. In siliceous soil. O. S. July-September.

*S. serotina* Walter. *P. serotinum* Trin. Glades. September.

### IXOPHORUS Schlecht. (*Setaria* Beauv.)

*Ixophorus verticillatus* (L.) Nash. *Setaria verticillata* Beauv. Fox tail grass. Sparingly found in fields and gardens. Introduced. July-September.

*I. glaucus* (L.) Nash. *Setaria glauca* Beauv. Yellow fox tail. Pigeon grass. Introduced and now ubiquitous. July-September.

*I. glaucus-lævigatus* Chapm. Cedar glades; very common. July-September.

*I. viridis* (L.) Nash. *Setaria viridis* Beauv. Introduced and now ubiquitous. July-September.

*I. italicus* (L.) Nash. *Setaria Italica* R. & S. Hungarian grass; Italian millet. In cultivation and frequently escaped into waste places. July-September.

*I. Germanicus* (Beauv.) Nash. *Setaria Germanica* Beauv. German millet. Both millets give important hay crops. July-September.

### CENCHRUS L.

*Cenchrus tribuloides* L. Burgass. On the sandy flats along Mississippi River. Frequently intermixed with *equisetum robustum*. August.

## PENNISSETUM Pers.

*Pennisetum typhoideum* Rich. Pearl millet. Introduced from the Orient; it is sometimes cultivated.

## ORYCEÆ.

## ZIZANIA L.

*Zizania aquatica* L. Indian rice. Near Humboldt, W. Tenn. Guthrie, Ky.

## ORYZA L.

*Oryza sativa* L. Rice. A variety called "upland rice" is here and there cultivated on a small scale in W. Tenn. M.

## HOMALOCENCHRUS Meig. (Leersia Swartz.)

*Homalocenchrus Virginicus* Britt. *Leersia Virginica* Willd. White grass; shady and damp locations. O. S. July-September.

*H. oryzoides* (L.) Poll. In swamps and along streams. O. S. July-September.

*H. lenticularis* (Michx.) Scribn. Catch-fly grass. W. Tenn. S. M. Bain.

## PHALARIDEÆ.

## PHALARIS L.

*Phalaris Canariensis* L. Canary grass. Food for canary birds, whence it frequently escapes.

*Ph. arundinacea* L. Reed grass. Introduced, with the next.

*Ph. arundinacea picta* L. The ribbon grass is frequently found in gardens and survives in abandoned garden plots, but the genuine *Ph. arundinacea* I have never seen in Tennessee spontaneous.

## ANTHOXANTHUM L.

*Anthoxanthum odoratum* L. Sweet vernal grass. Is frequently found in meadows in E. Tenn., in which part of the State it seems to thrive best. Introduced with grass seeds from Europe, it imparts the hay a sweet flavor.

## AGROSTIDEÆ.

## ARISTIDA L.

*Aristida dichotoma* Michx. Poverty grass. In poor, sandy soils. O. S. September, October.

*A. gracilis* Ell. In glades and sterile soils, with the former. September, October.

*A. ramosissima* Engelm. Sandy soil, Humboldt, W. Tenn. July-September.

*A. purpurascens* Poir. Paradise Ridge, Robertson County. July.

*A. oligantha* Michx. Dry, gravelly soils. O. S.

### STIPA L.

*Stipa avenacea* L. Black oat grass. Charleston, Bradley County; summit of Lookout Mountain. May, June.

### MUHLENBERGIA Schr.

*Muhlenbergia sobolifera* (Mühl.) Trin. Rocky woodlands. O. S. August, September.

*M. Mexicana* (L.) Trin. Thickets along water courses. O. S. August, September.

*M. sylvatica* Torr. Damp woodlands. O. S. September, October.

*M. tenuiflora* (Willd.) M. Willdenovii Trin. Woodlands of Middle Tennessee to the summits of the Smoky Mountains. July-September.

*M. diffusa* Schreb. Nimble Will, Dropseed grass. Pastures and grass plots; very common, and not liked by cattle. September, October.

*M. capillaris* (Lam.) Trin. A very graceful grass, with light purple panicle. In a cedar glade at Lavergne. July, August.

### BRACHYELYTRUM Beauv.

*Brachyelytrum erectum* (Schreb.) Beauv. *B. aristatum* R. & S. Dry woodlands. O. S. July-September.

### PHLEUM L.

*Phleum pratense* L. Timothy. Gives the best hay crop in the State. July, July.

### ALOPECURUS L.

*Alopecurus pratensis* L. Meadow foxtail. In meadows; introduced with other grass seeds. Scarce. June, July.

*A. geniculatus* L. Wet places. May-July.

*A. geniculatus aristulatus* Torr. In similar localities. Charlotte Pike, near West Nashville ("New Town"). June.

### SPOROBOLUS R. Br.

*Sporobolus asper* (Michx.) Kunth. Cedar glades at Lavergne; Knoxville. Scribn. October.

*S. vaginæflorus* (Torr.) Wood. *S. minor* Vasey. Poverty grass. Sterile, rocky places; very common. August-October.

*S. neglectus* Nash. *S. vaginæflorus* Vasey. With the former. September, October.

*S. Indicus* (L.) R. Br. Sweet grass. Sandy soils in the Cumberland Mts. and in the oak barrens. June-September.

### CINNA L.

*Cinna arundinacea* L. Indian reed grass. Wet, rich woodlands. O. S. A form smaller throughout is found on Paradise Ridge. August, September.

*C. pendula* Trin. On Roane Mountain. L. F. Scribner.

### AGROSTIS L.

*Agrostis alba* L. Redtop, herd's grass. One of the principal meadow grasses. Sometimes extensively stoloniferous. July, August.

*A. exarata* Trin. O. S. July-September.

*A. Elliotiana* Schult. *A. arachnoides* Ell. Dry, siliceous ground. O. S. May-July.

*A. canina* L. White Cliff Springs, Monroe County. July.

*A. rubra* L. *A. rupestris* Chapm. Summit of Roane Mountain. July.

*A. intermedia* Scribn. Common in damp thickets. O. S.

*A. perennans* Tuckerm. Open woodlands. O. S. July-September.

*A. Novæ - Angliæ* Tuckerm. Along mountain streams, E. Tenn. Scribn.

*A. hyemalis* (Walt.) B. S. P. *A. scabra* Willd. In dry or wet places. A noxious weed, but not frequent. July.

*A. altissima* Walt. *A. elata* Trin. Sandy soil, vicinity of Knoxville. A. Ruth.

### CALAMAGROSTIS Adans.

*Calamagrostis Canadensis* Beauv. Blue joint. Roane Mt. Chickering.

*C. cinnoides* (Mühl.) Scribn. *C. Nuttalliana* Steudel. Frog Mts. and Cumberland Mts. July, August.

### AVENACEÆ.

#### HOLCUS L.

*Holcus lanatus* L. Velvet grass. Naturalized in E. Tenn.; especially frequent in the mountains, in meadows as well as in open grounds. June, July.

**DESCHAMPSIA** Beauv.

*Deschampsia flexuosa* (L.) Trin. Mts. of E. Tenn., Ocoee Valley, and Lookout Mt. July.

**TRISETUM** Pers.

*Trisetum subspicatum* (L.) Beauv. var. *molle* Gray. Summit of Roane Mountain. F. L. Scribner. July.

*T. Pennsylvanicum* (L.) Beauv. *T. palustre* Torrey. Moist places throughout the Alleghanies. June, July.

**AVENA** L.

*Avena sativa* L. Oat. Cultivated; occurs frequently self-sown in fields and on roadsides. July.

Our common oats are, perhaps, derived from the wild oats of Europe. *Avena fatua* L. a variable species, through cultivation. There are distinguished two classes—"panicle oats," with widely-spreading panicles, and "banner oats," with panicles contracted and one-sided. Both of them vary again in the envelopment of the grain, being either "chaffy" or naked fruited. Oats are also distinguished by the color of the grain, as "white oats" or "black oats." Its cultivation reaches back into prehistoric times.

**ARRHENATHERUM** Beauv.

*Arrhenatherum elatius* (L.) Beauv. Oat grass. Old City Cemetery and in fence rows, vicinity of Nashville. June, July.

**DANTHONIA** D. C.

*Danthonia spicata* (L.) Beauv. Wild oat grass. Hilltops around Nashville, in siliceous soils. June.

*D. sericea* Nutt. Cedar glades, Edgefield Junction; dry soils in the ridges of E. Tenn. May, June.

*D. compressa* Aust. Throughout the higher mountains of E. Tenn. July.

**CHLORIDEÆ.****CAPRIOLA** Adans.

*Capriola Dactylon* (L.) Kuntze. *Cynodon Dactylon* Pers. Bermuda Grass. Does not mature seed and has to be propagated by cuttings. Along river banks and in grass plots, where it soon suppresses the other grasses. July-September.

**SPARTINA** Schreb.

*Spartina cynosuroides* (L.) Willd. Marsh grass. Brownsville, W. Tenn. September, October.

**CHLORIS** Sw.

**Chloris verticillata** Nutt. As a weed in the garden of J. Rath, in Cleveland. May-July.

**GYMNOPOGON** Beauv.

**Gymnopogon racemosus** Beauv. Barrens at Tullahoma. July.

**BOUTELOUA** Lag.

**Bouteloua curtipendula** (Michx.) Torr. *B. racemosa* Lag. Mesquite grass; Grama grass. Cedar glades, Lavergne. July.

**ELEUSINE** Gaert.

**Eleusine Indica** (L.) Gaertn. Crab grass. Introduced, and now in every waste place. O. S. June-September.

**LEPTOCHLOA** Beauv.

**Leptochloa mucronata** (Michx.) Kunth. In cultivated grounds. O. S. July-September.

## FESTUCEÆ.

**GYNERIUM** H. B. K.

**Gynerium argenteum** Nees. The Pampas grass is frequently cultivated for ornament, but is too tender to survive the winter in open grounds.

**ARUNDO** L.

**Arundo Donax** L. Reed. Cultivated for ornament, especially the white-banded var. *A. Donax variegata*. The common variety grows very tall (fifteen feet high), and both mature seed, but do not spread beyond cultivation. July-September.

**SIEGLINGIA** Bernh. (*Triodia* R. Br.)

**Sieglingia sessleroides** (Michx.) Scribner. (*Triodea cuprea* J. F. Jacq.) O. S. In all soils. September, October.

**ERAGROSTIS** Beauv.

**Eragrostis capillaris** (L.) Nees. Frequent in E. Tenn. Scribn.

**Eragrostis major** Host. *E. poaeoides* var. *megastrachya* Gray. In cultivated grounds. O. S. August, September. Introduced.

**E. Brownei** Kunth. Low and decumbent. Differs from

*Eragrostis minor*, and seems to be indigenous to the cedar barrens. July-September.

*E. Frankii* Steud. Abundant in the cedar glades; unpleasant smelling. July, August.

*E. pilosa* (L.) Beauv. Naturalized from Europe. Frequent around Knoxville. F. L. Scribn.

*E. Purshii* Schrad. Waste grounds, streets of Nashville. August, September.

*E. pectinacea* (Michx.) Steudel. *E. pectinacea* var. *spectabilis* A. Gray. Knoxville. A. Ruth. August, September.

*E. refracta* (Mühl.) Scribn. Dry uplands and cedar glades. M. Tenn. July-September.

*E. secundiflora* Presl. *E. oxylepis* Torr. Vicinity of Memphis. Dr. G. Egeling.

*E. hypnoides* (Lam.) B. S. P. *E. reptans* Nees. Wet, sandy soils and river banks. O. S. August, September.

#### EATONIA Raf.

*Eatonia obtusata* (Michx.) A. Gray. Hills on Cumberland River, below Nashville. May.

*E. Pennsylvanica* Gray. Copses around Nashville; common. May, June.

*E. filiformis* Vasey. Dry hills, Chester County. S. M. Bain.

*E. Dudleyi* Vasey. Copses. O. S. April, May.

#### MELICA L.

*Melica mutica* Walt. Shaded hillsides and ravines. O. S. May, June.

#### KORYCARPUS Zea. (Diarrhena Beauv.)

*Korycarpus diandrus* (Michx.) Kuntze. *Diarrhena Americana* Beauv. Rich soil; not very frequent. July-September.

#### UNIOLA L.

*Uniota latifolia* Michx. Creek and river bottoms. O. S. July-August.

*U. laxa* (L.) B. S. P. *U. gracilis* Michx. In thickets. E. Tenn. F. L. Scribn. Nashville. July, August.

*U. longifolia* Scrib. Perhaps a variety of the former. Tullahoma, Hiwassee Valley. A. Ruth.

#### DACTYLIS L.

*Dactylis glomerata* L. Orchard grass. Growing in tus-

socks, it is not adapted for meadow culture by itself; fully naturalized. June-October.

### CYNOSURUS L.

*Cynosurus cristatus* L. Has been recently introduced to cultivation in this State, and is naturalized in Canada and the Eastern States.

### POA L.

*Poa annua* L. Six weeks' grass. Introduced, and now everywhere abundant; annual. March-October.

*P. Chapmaniana* Scribn. *P. cristata* Chapm. Springy places, West Nashville ("New Town"), near Nashville; Knoxville. A. Ruth.

*P. compressa* L. English blue grass. Introduced and thoroughly naturalized. May-July.

*P. pratensis* L. Kentucky blue grass. Makes the best meadows in calcareous soils. June-August.

*P. trivialis* L. Occurs very rarely in this State. Introduced.

*P. autumnalis* Mühl. *P. flexuosa* Mühl. Moist thickets on Paradise Ridge, Davidson County. June, July.

*P. sylvestris* Gray. Woodlands. O. S. May.

*P. alsodes* Gray. Mts. of E. Tenn. F. L. Scribn.

*P. Wolfii* Scrib. Cedar glades at Lavergne. May, June.

*P. brevifolia* Mühl. Hillsides around Nashville. Knoxville. A. Ruth. April, May.

*P. debilis* Torr. On White Top Mountain, West Virginia, J. K. Small. Smoky Mts., E. Tenn.

### PANICULARIA Fabr. (Glyceria R. Br.)

*Panicularia elongata* (Willd.) Kuntze. *Glyceria elongata* Trin. Roane Mountain. F. L. Scribn.

*P. nervata* (Willd.) Kuntze. *Glyceria nervata* Trin. Wet meadows; common. O. S. June-September.

*P. acutiflora* (Torr.) Kuntze. *Glyceria acutiflora* Kuntze. One-mile Pond, near old waterworks, Nashville. June.

*P. pallida* (Torr.) Kuntze. Edge of a millpond in Ducktown. July.

*P. Americana* (Torr.) McMillan. *Glyceria aquatica* Smith. Bell's Bend, Davidson County; in low grounds near the Cumberland River. June, July.

*P. fluitans* (L.) Kuntze. In swamps and muddy places. O. S.

### FESTUCA L.

*Festuca octoflora* Walt. *F. tenella* Willd. Hilltops, siliceous ground, M. Tenn.; common. April, May.

*F. rubra* L. var. *glaucescens* Haeck. Rocky banks of Cumberland River, near Nashville. June, July.

*F. Myuros* L. Nashville, near lunatic asylum, introduced. Knoxville. Scribn.

*F. ovina* L. Sparingly occurring; introduced. Knoxville. F. L. Scribner.

*F. elatior* L. Tall Fescue grass; naturalized. The var. *arundinarea* Schreb. is found scatteringly in the vicinity of Nashville, the old Akin place. June, July.

*F. Shortii* Kunth. Collected in the barrens near Tullahoma. It greatly resembles *F. elatior*.

### BROMUS L.

*Bromus ciliatus* L. *B. purgans* L. Woods and thickets. O. S. July, August. The variety *purgans* Gray differs but little in pubescence.

*B. sterilis* L. Old field on Granny White Pike, near Nashville. June.

*B. hordaceus* L. *B. mollis* L. Soft chess. In fields and waste places. O. S. June.

*B. secalinus* L. Cheat, chess. A weed in grain fields. O. S. June-August.

*B. racemosus* L. Fields and pastures. O. S. June, July.

*B. unioloides* H. B. K. Recently introduced in this State in cultivation, and a plot of it was planted in the Centennial grounds. July.

### HORDEACEÆ.

#### LOLIUM L.

*L. temulentum* L. Darnel. Waste grounds. O. S. June-August.

*L. Italicum* A. Br. Introduced and sparingly cultivated. A plot of it was cultivated at Centennial grounds.

#### AGROPYRUM J. Gaertner.

*Agropyrum repens* (L.) Beauv. Couch grass. An extremely troublesome weed in fields and gardens, but not frequent in this latitude. Introduced. June-September. *M.*

*A. caninum* L. Occasionally introduced with field and garden seeds. July, August.

#### SECALE L.

*Secale cereale* L. Rye. This State is in the southern limit of profitable culture of this cereal. Still found spontaneously growing in Southern Russia, its original home is apparently

in the Caucasus and adjoining territories. First vestiges of its culture are found in the Swiss lake dwellings. *M.*

### TRITICUM L.

**Triticum sativum** L. Wheat. The origin of culture of the wheat in several varieties reaches back into prehistoric times. Grains are found embedded in Egyptian and Assyrian tiles. Indian and Hindoo myths relate its early use, as do likewise the sacred writings of the Hebrews. In our time we distinguish the following varieties, some of which are extensively cultivated in this State:

**T. sativum hibernum** L. Winter wheat.

**T. sativum æstivum** L. Summer wheat.

**T. sativum nudum** L. Unbearded wheat.

**T. sativum album** L. White wheat.

**T. sativum rubrum** L. Red or Mediterranean wheat.

The following species and varieties are less common in cultivation and have, perhaps, never been tried in Tennessee:

**T. turgidum** and **T. compositum** L. Turgid wheat. The latter is only a subvariety. The spikes of *T. compositum* are compound or ramified. It yields very heavy crops, and is best adapted to warm climates.

**T. durum** Desf. **T. rubrum** Kunth. Hard or horny wheat. Cultivated principally in Northern Africa and in Southern Spain.

**T. Polonicum** L. Grown mainly in Russia.

**T. Spelta** (L.) Spelt. This species is extensively cultivated in Southern Germany, Hungaria, and Russia in the fertile heavy red clay soils of these countries. It forms very large and heavy grains which adhere to the chaff from which they have to be separated like the chaff of the rice.

**T. dicoccum** Schrank. Two-grained wheat; adapted to high altitudes, resisting severe cold.

**T. monococcum** L. Single-grained wheat, reserved for the poorest rocky soils which would not support other varieties.

### HORDEUM L.

**Hordeum nodosum** L. *H. pratense* Huds. Wild barley. Dry, rocky places. O. S. May, June.

**Hordeum pusillum** Nutt. Similar localities like the former. O. S. May, June.

**H. distichum** L. Two-rowed barley. Long-eared barley. Heads flattened and two-ranked, husk attached to the grain. Cult.

**H. distichum Zeocriton** L. Battle-door barley, a variety of the former. Cult.

**H. vulgare** L. Grains arranged in four rows. Cult.

**H. hexastichum** L. Grains arranged in six rows. Cult.

The latter four species are found in cultivation only. They have ceased to mature germinating seed outside of cultivation in our latitude. *Hordeum distichum* is still found in a wild state in Western Asia and in Arabia Petraea; *Hordeum hexastichum* we know to have been cultivated in the remotest ages of which we possess records in Egypt and the Syro-Babylonian countries.

#### ELYMUS L.

**Elymus striatus** Willd. Wild rye. O. S. July, August.

**E. striatus villosus** Gray. In the barrens with the former. O. S. July, August.

**E. Canadensis** L. O. S. July.

**E. Canadensis glaucifolius** Gray. In the cedar glades. July-September.

**E. Virginicus** L. Very common. O. S. July.

#### HYSTRIX Mœnch.

**Hystrix Hystrix** (L.) Millsp. Bottle brush grass. *Asprella Hystrix* Willd. In rocky ground. O. S. June, July.

#### BAMBUSEÆ.

##### ARUNDINARIA Michx.

**Arundinaria gigantea** Chapm. Cane. Forming the canebrakes of all the Southern water courses. May-July.

**A. tecta** Mühl. Small cane. In low and high lands. Summit of Lookout Mt. O. S. The cane reaches maturity and dies off when the shoots attain 10°-15° height, and bears seeds from auxiliary branches. *A. tecta* is merely a young state throwing flowering shoots immediately from the roots.

#### CYPERACEÆ J. St. Hill.

##### CYPERUS L.

**Cyperus flavescens** L. In marshy ground. O. S. August-October.

**C. diandrus** Torr. With the former. July-September.

**C. rivularis** Kunth. *C. castaneus* Torr. In wet soil. O. S. August-October.

**C. inflexus** Mühl. *C. aristatus* Rottb. Glades and sandy river banks. O. S. July.

**C. pseudovegetus** Steud. *C. calcaratus* Nees. Damp soils. O. S. July.

**C. acuminatus** Torr and Hook. Cedar glades. Lavergne. July.

- C. virens* Michx. Brownsville. August.  
*C. rotundus* L. *C. Hydra* Michx. Old horticultural garden in North Nashville. July.  
*C. esculentus* L. *C. phymatodes* Mühl. Yellow nut grass. A pest in cultivated grounds. O. S. August, September.  
*C. esculentus angustispicatus* Britt. A variety very common about Nashville.  
*C. erythrorhizos* Mühl. River swamps. O. S. August, September.  
*C. Hallei* Torr. Reported from Tennessee in Illustrated Flora.  
*C. speciosus* Wahl. *C. Michauxianus* Torr. River banks and pools. Nashville. September.  
*C. strigosus* L. The most frequent species. O. S. August-October.  
*C. strigosus capitatus* Bøekl.  
*C. strigosus compositus* Britt.  
*C. strigosus robustior* Kunth.  
*C. strigosus elongatus* Britt. All these varieties are found promiscuously in the same range.  
*C. refractus* Engelm. On dry, rocky uplands. Nashville. August, September.  
*C. retrofractus* (L.) Torr. Hollow Rock, W. Tenn. August, September.  
*C. Lancastriensis* Port. Dry uplands. Old Cemetery, at Nashville. August, September.  
*C. ovularis* Torr incl. var. *robustus* Bøekl. and var. *sphericus* Bøekl. Frequent in the glades of M. Tenn.  
*C. filiculmis* Vahl. Dry uplands, vicinity of Nashville, and O. S. June-September.  
*C. echinatus* (Ell.) Wood. *C. Baldwinii* Torr. Knoxville. A. Ruth.

#### KYLLINGIA Rottb.

*Kyllingia pumila* Michx. Miry places. O. S. July, August.

#### DULICHIMUM L. C. Richard.

*Dulichium arundinaceum* (L.) Britton. Swamps along Cumberland and Tennessee Rivers. August-October.

#### ELEOCHARIS R. Br.

*Eleocharis mutata* (L.) R. & S. *E. quadrangulata* R. & S. Bogs along Cumberland River. July-September.

*E. ovata* (Roth.) R. & S. Bogs. O. S. July-September.

*E. Engelmanni* Steud. *E. ovata* var. *Engelmanni* Britt. Damp soil in the barrens. July.

*E. palustris* (L.) R. & S. Ponds and swamps. O. S. July-September.

*E. acicularis* R. Br. Wet lands. O. S. July-September.

*E. tenuis* (Willd.) Schultes. Barrens and highlands. O. S. July, August.

*E. acuminata* (Mühl.) Nees. *E. compressa* Sull. Frequent along water courses. O. S. June-August.

#### DICHROMENA Michx.

*Dichromena latifolia* Baldw. Barrens at Tullahoma. June-August.

#### FIMBRISTYLIS Wahl.

*Fimbristylis laxa* Wahl. Cedar glades, Lavergne. July-September.

*F. autumnalis* (L.) R. & S. Bogs and ditches. O. S. June-September.

#### STENOPHYLLUS Raf.

*Stenophyllus capillaris* (L.) Britton. *Fimbristylis capillaris* A. Gray. Sandy soil in the Cumberland Mts. June, July.

#### SCIRPUS L.

*Scirpus debilis* Pursh. Bogs, W. Tenn. August, September.

*S. lacustris* L. Bulrush. In a marshy meadow near railroad station, Cleveland, E. Tenn. June-September.

*S. fluviatilis* (Torr.) A. Gray. Bogs along Ocoee River, E. Tenn. June-September.

*S. atrovirens* Mühl. In bogs. O. S. June-August.

*S. polyphyllus* Vahl. O. S. June, July.

*S. cæspitosus* L. Roane Mt., Chickering.

*S. sylvaticus* L. Waters of Holston River. J. K. Small. June-August.

*S. carinatus* (H. & A.) Britton. Madison, W. Tenn. S. M. Bain. June-August.

*S. divaricatus* Ell. Jackson, W. Tenn. S. M. Bain. June-August.

*S. lineatus* Michx. *Eriophorum lineatum* Benth. & Hooker. Wet places in the glades. June-September.

*S. cyperinus* (L.) Kunth. *Eriophorum cyperinum* L. In swamps. O. S. August, September.

#### ERIOPHORUM L.

*Eriophorum polystachium* L. Cotton grass. Mountain bogs. E. Tenn. July.

*E. Virginicum* L. In bogs of the Cumberland Mts. June-September.

## HEMICARPHA Nees &amp; Arn.

*Hemicarpha micrantha* (Vahl.) Britton. Bottom lands along Cumberland River, near Nashville. July, August.

## RHYNCHOSPORA Vahl.

*Rhynchospora alba* Vahl. Bogs in the Cumberland Mts. and Alleghanies. July.

*Rh. glomerata* (L.) Vahl. Bon Air, Tullahoma, Lookout Mt. August.

*Rh. fusca* (L.) R. & S. Bogs in the Cumberland Mts. July, August.

*Rh. cymosa* Ell. Bogs. O. S. July, August.

*Rh. corniculata* (Lam.) A. Gray. Swamps. O. S. July-September.

## SCLERIA Berg.

*Scleria triglomerata* Michx. Lookout Mt., Tullahoma. July.

*Sc. pauciflora* Mühl. Dry glades, Lavergne. June-September.

## CAREX Ruppis Sedge.

*Carex follicularis* L. Mts. of S. W. Va. J. K. Small.

*C. intumescens* Rudge. Swamps along Cumberland River, E. Tenn. August, September.

*C. Asa Grayi* Bailey. Swamps in W. Tenn. September.

*C. lupuliformis* Sartw. *C. lupulina* var. *polystachya* Schw. & Torr. Swamps. O. S. August.

*C. bullata* Schku. Swamps. O. S. June-August.

*C. lurida* Wahl. *C. tentaculata* Mühl. Edgefield Junction, South Tunnel. August, September.

*C. Baileyi* Britt. *C. tentaculata* var. *gracilis* Booth. In Tennessee (fide) Illustrated Flora.

*C. hystericina* Mühl. Knoxville. A. Ruth. June-August.

*C. Frankii* Kunth. *C. stenolepis* Torr. Swamps. O. S. June-September.

*C. squarrosa* L. Bogs. O. S. June-September.

*C. Shortiana* Dewey. Tunnel Hill, Nashville, E. Tenn. May-July.

*C. scabrata* Schwein. E. Tenn. Curtiss. May, June. June.

*C. vestita* Willd. O. S. June, July.

*C. torta* Boott. S. W. Va. J. K. Small. E. Tenn. A. Ruth.

*C. prasina* Wahl. *C. miliacea* Mühl. Mts. of E. Tenn. May-July.

*C. crinita* Lam. Cumberland Mts., Whiteside. June, July.

*C. virescens* Mühl. Cumberland Mts., valley of E. Tenn. June, July.

*C. Caroliniana* Schwein. Hiwassee Valley. Kearney. May-July.

*C. gracillima* Schwein. Bogs. Jones' Bend, Davidson County. May-July.

*C. æstivalis* M. A. Curtis. Clingman Dome, summit. Roane Mt., Chickering. June-August.

*C. oxylepis* Torr. & Hook. Illustrated Flora for Tennessee. May, June.

*C. Davisii* Schwein. & Torr. Bogs, near Nashville. May-July.

*C. triceps* Michx. Glades of M. Tenn. April-August.

*C. tenuis* Rudge. *C. debilis* Michx. Bogs. Summer County. June, July.

*C. amphibola* Steud. *C. grisea* var. *angustifolia* Boott. O. S. April-June.

*C. glaucodea* Tuckerm. *C. grisea* var. *mutica* Carey. Moist thickets. O. S. June, July.

*C. flaccosperma* Dew. *C. laxiflora* var. *mutica* Torr. Thickets. O. S. June.

*C. granularis* Mühl. Wet meadows. O. S. May-July.

*C. Crawei* Dew. Cedar glades, Lavergne. May, June.

*C. oligocarpa* Schk. Paradise Ridge, Jones' Bend, Davidson County. June.

*C. Hitchcockiana* Dew. Adjoining Tennessee, Southwest Virginia. J. K. Small. May-July.

*C. laxiflora* Lam. Wet woodlands. O. S. May-July.

*C. plantaginea* Lam. Ducktown, E. Tenn. Waters of Holston River. J. K. Small. May, June.

*C. setifolia* (Dewey) Britton. *C. uburnea* Boott E. Tenn. A. Ruth. May-July.

*C. Pennsylvanica* Lam. Dry woodlands. O. S. May, June.

*C. varia* Mühl. *C. Emmonsii* Dewey. Nashville, Knoxville. A. Ruth. May-July.

*C. nigro-marginata* Schwein. Dry copses, Nashville. May-July.

*C. Jamesii* Schwein. *C. Steudellii* Kunth. Highlands. O. S. April, May.

*C. leptalea* Wahl. *C. polytrichoides* Willd. Mountain bogs, E. Tenn. June-August.

*C. Fraseri* Andr. Southwest Virginia, adjoining Tennessee. J. K. Small. May-July.

- C. juncea* Willd. Roane Mt. Chickering. July.  
*C. stipata* Mühl. White Top Mt. J. K. Small.  
*C. teretiuscula* Goodw. Mts. of E. Tenn. May-July.  
*C. vulpinoidea* Michx. O. S. June-August.  
*C. rosea* Schk. E. Tenn. May-July.  
*C. retroflexa* Mühl. Nashville. May-July.  
*C. radiata* Dewey. *C. rosea* var. *radiata* Britt. E. Tenn. A. Ruth.  
*C. sparganioides* Mühl. Rich woods. O. S. June-August.  
*C. cephalophora* Mühl. Nashville. Kingston Springs. May-July.  
*C. Mühlenbergii* Schk. Nashville. May-July.  
*C. sterilis* Willd. O. S. May-July.  
*C. canescens* L. O. S. Nashville. May-July.  
*C. brunnescens* Poir. *C. canescens* var. *alpicola* Wahl. Summit of White Top.  
*C. brunnescens gracilior* Britt. With the former. Mountains of Southwest Virginia and perhaps in the Smokies. J. K. Small. June, July.  
*C. cephaloidea* Dewey. Paradise Ridge, Davidson County. May-July.  
*C. tribuloides* Wahl. *C. lagopodioides* Schk. E. Tenn. A. Ruth.  
*C. scoparia* Schk. Mts. of E. Tenn. June, July.  
*C. cristatella* Britt. *C. cristata* Schwein. Southwest Virginia. J. K. Small.  
*C. macrokolea* Steud. *C. verrucosa* Ell. Madison, W. Tenn. S. M. Bain. June-August.  
*C. straminea* Willd. O. S. June, July.  
*C. Digitalis* Willd. Low grounds. O. S. June, July.  
*C. Careyana* Torr. Southwest Virginia. J. K. Small.  
*C. laxiculmis* Schwein. White Top Mt., Southwest Virginia. J. K. Small. May, June.  
*C. Atlantica* Bailey. *C. stellulata* var. *conferta* Chapm. Jackson. S. M. Bain. June.  
*C. Leavenworthii* Dewey. E. Tenn. A. Ruth.  
*C. Austro-Carolinensis* Britton. E. Tenn. A. Ruth.

## ARACEÆ Neck.

## ARISÆMA Mart.

- Arisæma triphyllum* (L.) Torrey. Indian Turnip. Jack-in-the-pulpit. Rich moist woodlands. O. S. April, May. *M.*  
*A. Dracontium* (L.) Schott. Dragon root. With the former. O. S. April, May.

## PELTANDRA Raf.

- Peltandra Virginica* (L.) Kunth. O. S. In swamps. July.

**SPATHYEMA** Raf. *Symplocarpus* Salisb.

*Spathyema fœtida* (L.) Salisb. *Symplocarpus fœtidus* Nutt. Mountain bogs, E. Tenn.; Duck River, M. Tenn. Skunk cabbage. February-April. *M.*

**ORONTIUM** L.

*Orontium aquaticum* L. Golden Club. Cleveland, E. Tenn. With *Peltandra*. April.

**ACORUS** L.

*Acorus Calamus* L. Calamus root. E. Tenn. Perhaps from imported stock. Cultivated here and there. *M.*

## LEMNACEÆ Dumort.

**SPIRODELA** Schleid.

*Spirodela polyrhiza* (L.) Schleiden. In all ponds. O. S.

**LEMNA** L.

*Lemna trisulca* L. Ponds and ditches. O. S.

*L. gibba* L. Duck weed. In all ponds. O. S.

*L. minor* L. With the former.

*L. perpusilla* Torr. Shelby Pond, Nashville. June, July.

**WOLFFIA** Horkel.

*Wolffia Columbiana* Karst. Slightly submerged and frequently adhering to other aquatics. Stagnant ponds near Nashville. June, July.

*W. Brasiliensis* Weddel. Floating on the surface. In a pond on the grounds of the Tennessee Hospital for the Insane. June, July.

## XYRIDACEÆ Lindley.

**XYRIS** L.

*Xyris flexuosa* Mühl. Yellow-eyed grass. In a swamp in Hadley's Bend, in Davidson County. Marshy regions in the oak barrens at Tullahoma. July-September.

*X. montana* H. Ries. *X. flexuosa* var. *pusilla* Gray. Mountain meadows and brooks. Mts. of E. Tenn. July, August.

## ERIOCAULONACEÆ.

**ERIOCAULON** Lindl.

*Eriocaulon decangulare* L. Pipewort. Mountain meadows of E. Tenn. June-October.

## COMMELINACEÆ Reichenb.

## COMMELINA L.

*Commelina nudiflora* L. Day flower. Alluvial banks. O. S. July, August.

*C. hirtella* Vahl. Shaded bluffs, Nashville. August-October.

*C. Virginia* L. Copses. O. S.

*C. Virginia angustifolia* Michx. Cedar glades of M. Tenn. July, August.

## TRADESCANTIA L.

*Tradescantia Virginiana* L. Spiderwort. Rich woodlands. O. S. May.

*T. montana* Schuttlw. Wolf Creek, Cocke County, E. Tenn. T. H. Kearney. June, July.

*T. brevicaulis* Raf. Bluffs on Mill Creek, Nashville. June.

## PONTEDERIACEÆ Dumort.

## PONTEDERIA L.

*Pontederia cordata* L. Pickerel weed. Wild Goose Pond, near Mitchellville, Robertson County. June-October.

## HETERANTHERA R. &amp; P.

*Heteranthera uniformis* R. & P. Mud plantain. Ditches and ponds. O. S. August.

*H. limosa* (Sw.) Willd. With the former. O. S. Ponds near Nashville. August.

*H. dubia* (Jacq.) MacM. *Schollera graminifolia* A. Gray. Water star grass. E. and W. Tenn.

## JUNCACEÆ Vent.

## JUNCUS L.

*Juncus effusus* L. Common rush. In swamps and moist places. O. S. June-September.

*J. bufonius* L. Toad rush. In clayey soil. July-October.

*J. tenuis* Willd. Roadsides in damp soil; very common. O. S. June.

*J. secundus* Beauv. *J. tenuis* var. *secundus* Engelm. E. Tenn. Oakland Station, Robertson County.

*J. setaceus* Rostk. Along streams. O. S. June, July.

*J. repens* Michx. Miry places in the barrens of M. Tenn. Tullahoma. June-August.

*J. marginatus* Rostk. Mts. of E. Tenn. and in the oak barrens of M. Tenn. June.

- J. pelocarpus* E. Meyer. Tullahoma. July.  
*J. articulatus* L. Cleveland, E. Tenn. July.  
*J. Canadensis* J. Gray. Mts. of E. Tenn. August, September.  
*J. acuminatus* Michx. O. S. Var. *legitimus* Engelm. August.  
*J. acuminatus debilis* (A. Gray). Engelm.  
*J. robustus* (Engelm.) Coville. Hollow Rock, W. Tenn. August, September.  
*J. diffusissimus* Engelm. Ponds in the barrens at Tullahoma.  
*J. leptocaulis* Torr. & Gray. Cedar glades of M. Tenn. May, June.

### JUNCOIDES Adans. (*Luzula* DC.)

- Juncoides pilosum* (L.) Kuntze. Wood rush. *Luzula pilosa* Willd. O. S. April, May.  
*J. campestre* (L.) Kuntze. *Luzula campestris* DC. Woodlands. O. S. June, July.

### MELANTHACEÆ R. Br.

#### XEROPHYLLUM Michx.

- Xerophyllum asphodeloides* Michx. Turkey beard. Dry woodlands, E. Tenn. A. Ruth. May-July.

#### CHAMÆLIRIUM Willd.

- Chamælorium luteum* (L.) A. Gray. Blazing star. Ch. Carolinianum Willd. Dry woodlands. O. S. May-July. *M.*

#### CHROSPERMA Raf. (*Amianthium* A Gray.)

- Chrosperma muscætoxicum* (Walt.) Kuntze. *Amianthium muscætoxicum* A. Gray. Fly poison. Boggy woodlands, E. Tenn. Cave Spring, Roane County. May, June.

#### STENANTHIUM Kunth.

- Stenanthium gramineum* (L.) Morong. *St. angustifolium* Kunth. Chillowee and Cumberland Mts. July, August.  
*St. robustum* S. Watson. Wet ground. Tullahoma, South Tunnel, and in the Frog Mts., E. Tenn. July.

#### ZYGADENUS Michx.

- Zygadenus leimanthoides* S. Watson. Frog Mts., E. Tenn. July.  
*Z. angustifolius* S. Watson. Barrens at Tullahoma. June.

**MELANTHIUM L.**

**Melanthium Virgicum** L. Bush flower. High mountains of E. Tenn. July.

**M. parviflorum** S. Watson. With the former. June, July.

**VERATRUM L.**

**Veratrum viride** Ait. American white hellebore. Indian poke. Wolf Creek and Bench Mt., Cocke County, E. Tenn. May-July. *M.*

**UVULARIA L.**

**Uvularia perfoliata** L. Bellworth. South Tunnel, Sumner County. Highlands of M. Tenn. May, June.

**U. grandiflora** J. E. Smith. Rich soil on the bluffs of Cumberland River. Paradise Ridge. April-June.

**U. sessilifolia** L. Oakland Station, Robertson County. June, July.

**U. puberula** Michx. Oakesia puberula S. Watson. Southwest Virginia, adjoining Tennessee. J. K. Small.

**LILIACEÆ Adans.****HEMEROCALLIS L.**

**Hemerocallis fulva** L. Day lily. Introduced and escaped from cultivation. Near old homesteads. June, July.

**H. flava** L. Introduced and sometimes astray. June, July.

**ALLIUM L.**

**Allium tricoccum** Ait. Wild leek. Mts. of E. Tenn. June, July.

**A. cernuum** Roth. Wild onion. Frequent. O. S. July, August.

**A. vineale** L. Crow garlick. A weed in cultivated grounds. Old City Cemetery, Nashville. June, July.

**A. Alleghanense** John K. Small. Buffalo Park, Wolf Creek. H. Allen.

**A. Canadense** L. Moist thickets. O. S. May, June.

**A. mutabile** Michx. Cedar glades, Lavergne. May.

The following species are in general cultivation:

**A. Cepa** L. The onion, in several varieties.

**A. sativum** L. Garlic.

**A. Porrum** L. Leek.

**A. Ascallonicum** L. Shallot.

**A. Scorodoprasum** L. Rocambole or potato onion.

**A. Schoenoprasum** L. Chive.

**NOTHOSCordiUM** Kunth.

*Nothoscordum bivalve* (L.) Britton. Frequent. O. S. March-June.

**LILIUM** L.

*Lilium Philadelphicum* L. Red lily. Cumberland Mts. Mrs. J. Bennett.

*L. Canadense* L. Yellow lily. Moist woodlands. Paradise Ridge. Mountains about Ducktown, E. Tenn. July.

*L. Grayi* S. Watson. Summit of Roane Mt. Prof. A. Gray. Chickering. July.

*L. superbum* L. Turk's-cap lily. High peaks of the East Tennessee mountains. Frog Mt. July.

*L. Carolinianum* Mich. Mountain region of E. Tenn., adjoining North Carolina. July.

**ERYTHRONIUM** L.

*Erythronium Americanum* Ker. Yellow adder's tongue. O. S. April. *M.*

*E. albidum* Nutt. White adder's tongue. White's Bend, below Nashville. Roane Mt., E. Tenn. Canby.

**QUAMASIA** Raf.

*Quamasia hyacinthina* (Raf.) Britton. *Scilla Fraseri* A. Gray. Wild hyacinth. Rich woodlands. O. S. April.

**SCHOENOLIRIUM** Gray.

*Schoenolirium croceum* Gray. Moist places in the cedar glades at Lavergne. May.

**ORNITHOGALUM** L.

*Ornithogalum umbellatum* L. Star of Bethlehem. Naturalized from Europe. Frequent in grass plots and fields. May-June.

**MUSCARI** Mill.

*Muscari botryoides* L. Grape hyacinth. Adventive from Europe. Escaping in adjoining fields. April.

**ALETRIS** L.

*Aletris farinosa* L. Star grass. Colic root. Frequent in the oak barrens. O. S. June. *M.*

**YUCCA** L.

*Yucca filamentosa* L. Adam's needle. Dry, rocky ground. O. S. May.

## CONVALLARIACEÆ Lindl.

## ASPARAGUS L.

*Asparagus officinalis* L. Escaped from cultivation and naturalized. May, June.

## CLINTONIA Raf.

*Clintonia borealis* Raf. Summits of the Smoky Mts., White Top Mt., Pine Mt. S. W. Va. J. K. Small.

*C. umbellata* Torr. Big Frog Mt., Smoky Mts. June.

## VAGNERA Adans. (Smilacina Desf.)

*Vagnera racemosa* (L.) Morong. Wild spikenard. Rich woodlands. O. S. May-July.

*V. stellata* (L.) Morong. Solomon's seal. Waters of Holston River. J. K. Small. June.

## UNIFOLIUM Adans.

*Unifolium Canadense* (Desf.) Greene. *Smilacina bifolia* var. *Canadensis* A. Gray. Summit of Big Thunderhead, Smoky Mts. May-July.

## DISPORUM Salisb.

*Disporum lanuginosum* (Michx.) Nichols. *Prosartes lanuginosa* Don. Rich woodlands. O. S. May, June.

*D. maculatum* Benth. & Hooker. *Prosartes maculata* Gray. Mts. of E. Tenn.

## STREPTOPUS Michx.

*Streptopus roseus* Michx. Smoky Mts., Big Thunderhead. May-July.

## POLYGONATUM Adans.

*Polygonatum biflorum* (Walt.) Ell. Hairy. Solomon's seal. Woods and thickets. O. S. April-July.

*P. commutatum* (R. & S.) Dietrich. *P. giganteum* Diet. Solomon's seal. In rich, moist woodlands. Along water courses. May-July.

## CONVALLARIA L.

*Convallaria majalis* L. Lily of the valley. Frequent in cultivation, but native of the higher Alleghanies. Little and Big Frog Mt., E. Tenn. May, June. *M.*

## MEDEOLA L.

*Medeola Virginiana* L. Indian cucumber root. Cumberland and Alleghany Mts. May.

## TRILLIUM L.

*Trillium sessile* L. Wake robin. Moist woodlands. O. S. April.

*T. recurvatum* Beck. With the former. Nashville. Eaglesville, Rutherford County. S. M. Bain. April-June.

*T. grandiflorum* (Michx.) Salisb. Hills west of Nashville, Cumberland Mts., Knoxville. A. R  th. April.

*T. erectum* L. O. S. April. *M.*

*T. cernuum* L. Lookout Mt., Ducktown. April.

*T. undulatum* Willd. *T. erythrocarpum* Michx. Ocoee Valley, Polk County. White Top Mt., Southwest Virginia. J. K. Small.

*T. Underwoodii* n. sp. J. K. Small in Torr. Botanical Bulletin, April, 1897. North Carolina and Tennessee mountains. April, May.

*T. viride* Beck. *T. sessile* var. *Nuttallii* S. Watson. Woods and glades. Tennessee to Missouri. April, May.

*T. luteum* Small. ined. Rich woods. Knox County. A. Ruth. May.

## SMILACEÆ Vent.

## SMILAX L.

*Smilax herbacea* L. Carion flower. Woods and thickets. O. S. April-June. *M.*

*S. tamnifolia* Michx. In dry soil. O. S. May, June.

*Smilax ecirrhata* S. Watson. Southwest Virginia, adjoining Tennessee. J. K. Small. May, June.

*S. glauca* Walter. Greenbrier. Dry, sandy soil. O. S. May, June.

*S. rotundifolia* L. *S. quadrangularis* Willd. Greenbrier, Horsebrier. Very abundant in M. Tenn.

*S. rotundifolia crenulata* Small & Heller. Waters of Holston River. J. K. Small. June.

*S. hispida* M  hl. Low, moist thickets. Nashville. O. S. June, July.

*S. Pseudo-China* L. Sarsaparilla. Tuberos rootstock, locally known as sarsaparilla. Along river banks and up to the mountains. March-August. *M.*

*S. Bona-nox* L. *S. tamnoides* A. Gray. In thickets. O. S. April-June.

*S. laurifolia* L. Foot of Lookout Mt. Memphis. An evergreen, useful for decorations. March-September.

*S. Walteri* Pursh. In wet ground. Credited to Tennessee in Illustrated Flora.

## AMARYLLIDACEÆ Lindl.

## HYMENOCALLIS Salisb.

*Hymenocallis occidentalis* (Le Conte), Kunth. *Pancreatium Carolinianum* L. Moist, meadow lands. O. S. July-September.

## AGAVE L.

*Agave Virginica* L. In dry soil. O. S. July, August.

## HYPOXIS L.

*Hypoxis erecta* L. Star grass. In dry glades. O. S. May.

## DIOSCOREACEÆ Lindl.

## DIOSCOREA L.

*Dioscorea villosa* L. Wild yam root. In moist thickets. O. S. June, July. *M.*

*D. Batatas* L. Is sometimes found as an ornamental vine in our gardens, but is not cultivated for its deeply-buried tubers.

## IRIDACEÆ Lindl.

## IRIS L.

*Iris versicolor* L. Larger Blue Flag. In marshes and thickets. O. S. May-July. *M.*

*I. hexagona* Walter. On the western side of Tennessee River at Johnsonville. Hollow Rock. April, May.

*I. prismatica* Pursh. *I. Virginica* Mühl. Abundant in the wet oak barrens east of Tullahoma. May, June.

*I. Germanica* L. Fleur-de-lis. On an abandoned garden plot on Charlotte Pike, near Nashville. May, June.

*I. fulva* Ker. *I. cuprea* Pursh. W. Tenn., near Humboldt. May, June.

*I. cristata* Ait. On hillsides and in open woodlands. O. S. April, May.

*I. verna* L. Cumberland Mts. Rugby. Mrs. Percival. April, May.

## NEMASTYLIS Nutt.

*Nemastylis acuta* (Bart.) Herb. *Ixia acuta* Bart. Credited to Tennessee in the Illustrated Flora.

GEMMINGIA Fabr. (*Pardanthus* Ker.)

*Gemmingia Chinensis* (L.) Kuntze. *Pardanthus Chinensis* Ker. Blackberry lily. O. S. Very abundant. I collected it already fifty years ago in the remotest mountain

glens, and think it is really indigenous, not naturalized from Asia. June.

### SISYRINCHIUM L.

*Sisyrinchium graminoides* Bicknell. Blue-eyed grass. *Sisyrinchium anceps* Wats. O. S. April-June.

*S. angustifolium* Mill. *S. mucronatum* Michx. O. S. May, June.

### ORCHIDACEÆ Lindl.

#### CYPRIPEDIUM L.

*Cypripedium reginæ* Walt. *C. spectabile* Salisb. Lady's slipper. Ducktown. June-September.

*C. hirsutum* Mill. *C. pubescens* Willd. Paradise Ridge, near Nashville; Lookout Mt., and throughout the Cumberland Mts. May, June. *M.*

*C. parviflorum* Salisb. Hills near Nashville. Mts. of E. Tenn. May-July.

*C. acaule* Ait. Moccasin flower. Alleghanies and Cumberland Mts. May.

#### ORCHIS L.

*Orchis spectabilis* L. Rich woodlands around Nashville. April, May.

#### HABENARIA Willd.

*Habenaria orbiculata* (Pursh.) Torrey. Slopes of White Top Mt., Southwest Virginia, adjoining Tennessee. J. K. Small. July.

*H. integra* (Nutt.) Sprengel. Tullahoma, Mitchellville. July.

*H. bracteata* (Willd.) R. Br. Waters of Holston River. J. K. Small. May.

*H. clavellata* (Michx.) Spreng. *H. tridentata* Willd. Frequent in the Cumberland and Alleghany Mts. July, August.

*H. flava* (L.) A. Gray. *H. virescens* Spreng. Bogs, W. Tenn. June.

*H. cristata* (Michx.) R. Br. Sewanee, Cumberland Mts. July, August.

*H. ciliaris* (L.) R. Br. Edgefield Junction. E. Tenn. July, August.

*H. blephariglottis* (Willd.) Torrey. Tullahoma. August.

*H. psycodes* (L.) A. Gray. White Top Mt., S. W. Va. J. K. Small.

*H. peramœna* A. Gray. Cedar Hill; Mitchellville, Robertson County. July.

*H. Michauxii* Nutt. Grassy Cove, in the Cumberland Mts. Mrs. L. Bennett. July.

**POGONIA** Juss.

*Pogonia ophioglossoides* (L.) Ker. Snake-mouth. Hiwassee, Polk County. June, July.

*P. trianthophora* (Sw.) B. & P. *P. pendula* Lindl. In leaf mold in the highlands of M. Tenn., Mitchellville, Wartrace. Frequent. August, September.

*P. divaricata* (L.) B. Br. Mts. of E. Tenn. July.

*P. verticillata* Nutt. Sewanee. E. Kirby-Smith. July.

**GYROSTACHYS** Pers. (*Spiranthes* L. C. Rich.)

*Gyrostachys plantaginea* (Raf.) Britton. *Spiranthes latifolia* Torr. Lady's tresses. Southwest Virginia, adjoining Tennessee. J. K. Small. June-August.

*G. cernua* (L.) Kuntze. *Spiranthes cernua* L. Barrens around Tullahoma. August.

*G. præcox* (Walt.) Kuntze. *Spiranthes præcox* S. Watson. Grassy places. O. S. July, August.

*G. simplex* (A. Gray) Kuntze. Harpeth hills, south of Nashville, in siliceous soil. Abundant. August, September.

*G. gracilis* (Bizel.) Kuntze. Grass plots around Nashville. Barrens. September.

**LISTERA** R. Br.

*Listera convallarioides* (Sw.) Torrey. Twai-blade. Slopes of White Top Mt., Southwest Virginia. J. K. Small. June-August.

*L. australis* Lindl. E. Tenn. A. Ruth.

**PERAMIUM** Salisb. (*Goodyera* R. Br.)

*Peramium repens* (L.) Salisbury. *Goodyera repens* R. Br. Rattlesnake plantain. O. S.

*P. pubescens* (Willd.) McM. Mts. of E. Tenn. July.

**ACHROANTHES** Raf. (*Microstylis* Nutt.)

*Achroanthes unifolia* (Michx.) Raf. *Microstylis ophioglossoides* Nutt. Adder's mouth. Cumberland Mts. Mrs. L. Bennett. Lemon's Gap. A. Ruth.

**LEPTORCHIS** Thouars. (*Liparis* L. C. Richard.)

*Leptorchis liliifolia* (L.) Kuntze. *Liparis liliifolia* L. C. Rich. W. Tenn. S. M. Bain. S. W. Va. J. K. Small. May-July.

*L. Loesellii* (L.) McM. Waters of Holston River. J. K. Small. May-July.

**CORALLORHIZA** R. Br.

*Corallorhiza Corallorhiza* (L.) Karst. *C. innata* R. Br. Coral root. Highlands of Middle Tennessee. May, June.

*C. odontorhiza* (Willd.) Nutt. Harpeth hills, south of Nashville. July-September. *M.*

*C. multiflora* Nutt. In leaf mold in dry woodlands. O. S. June, July.

*C. Wisteriana* Conn. E. Tenn, Hiwassee Valley. R. Ruth.

**TIPULARIA** Nutt.

*Tipularia unifolia* (Mühl.) B. & P. *T. discolor* Nutt. Crane fly Orchis. Vicinity of Ducktown, in Fanning County, Ga. July, August.

**LIMODORUM** L. (*Calopogon* R. Br.)

*Limodorum tuberosum* L. *Calopogon pulchellus* R. Br. Grass pink. Mts. of E. Tenn. and oak barrens of M. Tenn. June, July.

**HEXALECTRIS** Raf. (*Bletia* Nutt.)

*Hexalectris aphylla* (Nutt.) Raf. *Bletia aphylla* Nutt. Parksville, Polk County. Dry hills east of Cleveland. Under pines (E. Tenn.), and also under oaks (hills of Davidson County). July, August.

**APLECTRUM** Nutt.

*Aplectrum spicatum* (Walt.) B. S. P. *Aplectrum hyemale* Nutt. Potty root. Mts. of E. Tenn. S. W. Va. J. K. Small. May-July.

**SUBCLASS 2. DICOTYLEDONES.****SAURURACEÆ** Lindl.**SAURURUS** L.

*Saururus cernuus* L. Lizard's tail. In stagnant waters. O. S. June-August.

**JUGLANDACEÆ** Lindl.**JUGLANS** L.

*Juglans nigra* L. Black walnut. O. S. *M.*

*J. cinerea* L. Butternut. White walnut. Creek and river bottom lands. O. S. April, May. Fruit ripe in October. *M.*

*J. regia* L. The English walnut is sparingly introduced, and seems to grow well.

**HICKORIA** Raf. (*Carya* Nutt.)

**Hickoria Pecan** (Marsh.) Britton. Pecan. Tennessee and Mississippi bottoms in West Tennessee. Some large trees in the vicinity of Nashville have been planted by early settlers.

**H. minima** (Marsh.) Britton. *Carya amara* Nutt. Swamp hickory. Bitternut. Swampy grounds along Cumberland River below Nashville. May, June. Fruit in October.

**H. ovata** (Mill.) Britton. *Carya alba* Nutt. Shell-bark hickory. O. S. May. Fruit in September.

**H. laciniosa** (Michx. fil) Sargent. Big shag bark. King-nut. *Carya sulcata* Nutt. In rich soil. O. S. May. Fruit in September, October.

**H. alba** (L.) Britton. *Carya tomentosa* Nutt. Mockernut. O. S. May. Fruit in October.

**H. microcarpa** (Nutt.) Britton. *Carya microcarpa* Nutt. Lookout Mt. May. Fruit in October.

**H. glabra** (Mill.) Britton. *Carya porcina* Nutt. Pignut hickory. Very frequent on the Cumberland Plateau. May, June. Fruit in October, November.

\***H. Carolinæ-septentrionalis** Ashe. Tennessee. (Vide Illustrated Flora; Appendix, page 511.)

## SALICACEÆ Lindl.

**POPULUS** L.

**Populus alba** L. Abele. White or silver-leaf poplar. Native from Europe. Roadsides and yards. Difficult to eradicate where it is undesirable. March.

**P. balsamifera candicans** (Ait.) A. Gray. Balm of Gilead. Transplanted from the Northern territories, it escaped cultiva-

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\***H. Carolinæ-septentrionalis** Ashe. A small tree attaining a maximum height of eighty feet and a diameter of two and one-half feet, with gray bark, hanging in long, loose strips; bud scales, from eight to ten, imbricate, the inner greatly enlarging in leafing, and tardily deciduous; terminal bud, ovate-lanceolate, truncate, the scales spreading, barely one-third inch long; lateral buds, oblong; twigs very slender, one-eighth inch thick, glaucous, smooth, purplish-brown; staminate aments in threes, glabrous on short peduncles at base of shoots of the season; stamens, glabrous; ovary, glabrous; young foliage blackening in drying, glabrous, ciliate, with few resinous globules; leaflets, three to five; the two upper, three-fourths inch to one and one-fourth inches wide, four to six inches long, lanceolate; lower pair, often smaller; fruit, subglobose, three-fourths inch to one and one-fourth inch long; husk, soon falling into four pieces; nut, white or brownish, much compressed, angled, cordate or subcordate at top, thin-shelled; seed, large and sweet.

tion, and is scatteringly found in the woods in E. Tenn. April. *M.*

*P. heterophylla* L. Swamp or downy poplar. In wet woodlands. April, May.

*P. grandidentata* Michx. Credited to our State in Gray's Manual.

*P. deltoides* Marsh. Cottonwood. *P. monilifera* Ait. Frequent in all parts of the State. April, May.

*P. dilatata* Ait. Lombardy poplar. Frequently planted, but short-lived in this State.

### SALIX L.

*Salix nigra* Marsh. Black willow. Banks of streams. O. S. April, May. *M.*

*S. Wardii* Bebb. Along Cumberland River, Nashville. April.

*S. lucida* Mühl. Mts. of E. Tenn. April, May.

*S. Babylonica* L. Weeping willow. Widely cultivated. O. S. Native of Asia. April.

*S. purpurea* L. Basket willow. Introduced and cultivated for wickerware. March, April.

*S. humilis* Marsh. Prairie willow. In the oak barrens in dry soil and on the high mountains. Summit of Big Frog Mt. April.

*S. tristis* Ait. Dwarf gray willow. In dry barrens. Tullahoma. March, April.

*S. sericea* Marsh. Banks of White Top Creek, S. W. Va. J. K. Small. May.

*S. petiolaris* J. E. Smith. Frequent around Nashville. Grows to a tree thirty feet high. April.

*S. longifolia* Mühl. *S. fluviatilis* Nutt. W. Tenn. April, May.

*S. alba* L. Introduced from Europe. In moist soil. April. *M.*

### BETULACEÆ Agardh.

#### CARPINUS L.

*Carpinus Caroliniana* Walt. American hornbeam. Water beech. In moist woods. O. S. April, May. Fruit ripe in August, September.

#### OSTRYA Scop.

*Ostrya Virginiana* (Mill.) Willd. Hop hornbeam. Ironwood. In dry lands. O. S. April, May. Fruit ripe in July, August.

## CORYLUS L.

*Corylus Americana* Walt. Hazelnut. From the mountains to the Mississippi bottoms, in which it forms widespread thickets. March, April. Nuts ripe in July.

*C. rostrata* Ait. Dense undergrowth in the Alleghanies. April, May. Nuts ripe in August.

## BETULA L.

*Betula nigra* L. Red birch. A slender tree lining water courses. Frequent in W. Tenn. April, May.

*B. lenta* L. Sweet birch. Black birch. Cumberland and Alleghany Mts. April, May. *M.*

*B. lutea* Mich. Gray birch. Summit of Thunderhead. May.

## ALNUS Gærtn.

*Alnus Alnobetula* (Ehrh.) K. Koch. Mountain alder. *Alnus viridis* DC. Mts. of E. Tenn. May, June.

*A. rugosa* (Du Roi.) K. Koch. Smooth alder. In wet soil or hillsides. O. S. March. *M.*

## FAGACEÆ Drude.

## FAGUS L.

*Fagus Americana* Sweet. *F. ferruginea* Ait. American beech. O. S. Large forest tree, attaining from 50 to 120 feet in height. April, May. Fruiting in September, October.

## CASTANEA Adans.

*Castanea dentata* (Marsh.) Barkl. *C. vesca* var. *Americana* Michx. American chestnut. A large forest tree preferring siliceous soil, attaining from 80 to 100 feet. Most numerous in the Cumberland Mts. June, July. Nuts ripe in October.

*C. pumila* (L.) Mill. Chinquapin. A shrub or small tree, preferring siliceous soil. O. S. June. Nuts ripe in September.

## QUERCUS L.

*Quercus rubra* L. Red oak. A large tree, attaining in rich land a height of 140 feet by 7 feet diameter. O. S. May. Acorns ripe in October, November. *M.*

*Q. Texana* Buckley. Texan red oak. A large tree when in suitable soil. O. S. April, May. Acorns ripe in September, October. *Q. palustris* Du Roi of first edition.

*Q. coccinea* Wang. Scarlet Oak. Big tree from 80 to 100 feet high by from 4 to 5 feet diameter. O. S. May, June. Acorns ripe in September, October.

*Q. velutina* Lam. *Q. tinctoria* Bartram. *Q. coccinea* var. *tinctoria* A. Gray. Black oak. Quercitron. Large forest tree. Maximum height, about 150 feet; trunk diameter, 5 feet. O. S. April, May. Fruit maturing the next season. *M.*

*Q. digitata* (Marsh.) Ludw. Spanish oak. (*Q. falcata* Michx.) Maximum height, 90 feet by 5 feet diameter. In siliceous soil. May, June. Acorns ripe in October.

*Q. nana* (Marsh.) Sargent. *Q. ilicifolia* Wang. Bear or scrub oak. Dry, gravelly places in the barrens. May. Acorns maturing in October.

*Q. Marylandica* Mönch. Black-jack oak. Stony, gravelly ridges, siliceous formations. O. S. May, June. Acorns mature in October.

*Q. nigra* L. Water oak. Maximum height, about 80 feet; diameter, 4 feet. In siliceous and argillaceous soils. M. and E. Tenn. Prefers the banks of streams. Ocoee Valley. April, May. Acorns in September, October. Fruiting the second year.

*Q. Phellos* L. Willow oak. Large tree, attaining from 80 to 100 feet by 3 feet diameter. Prefers moist situations in argillaceous soils. O. S. April, May. Fruit maturing in September. Fruiting the second year.

*Q. imbricaria* Michx. Shingle oak. Attaining 100 feet by 3½ feet diameter. Especially frequent in the basin of M. Tenn. April, May. Fruit maturing the second year.

*Q. alba* L. White oak. Maximum height, 150 feet by 5 feet diameter. O. S. May, June. Acorns mature in September, October. *M.*

*Q. minor* (Marsh.) Sargent. Post oak. Biggest size, 100 feet; diameter of trunk, 4 feet. In dry soil. O. S. May, June. Acorns mature same year in September, October.

*Q. lyrata* Walt. Overcup oak. In moist soil, mostly in M. Tenn. Height, 100 feet by 3 feet diameter. April, May. Fruit maturing the first season.

*Q. macrocarpa* Michx. Mossy cup or bur oak. A large tree, attaining 160 feet by 8 feet diameter. Loves rich bottom lands. O. S. May, June. Acorns maturing the same season. They are sometimes 2 inches high.

*Q. platanoides* (Lam.) Ludw. *Q. bicolor* Willd. Swamp white oak. A large tree, attaining 110 feet by 9 feet diameter. Mississippi bottoms. May, June. Acorns mature in September, October.

*Q. Michauxii* Nutt. Cow oak. Attaining 100 feet by 7 feet diameter. Rich bottom lands. O. S. April, May. Acorns ripe in September, October.

*Q. Prinus* L. Rock chestnut oak. Rocky, but rich, hill-

sides. Slopes of the Cumberland Mts. Bark gathered for tanning. May, June. Acorns ripe in October, November.

**Q. acuminata** (Michx.) Sarg. *Q. Mühlenbergii* Engelm. Dry or damp limestone soil. Frequent in Davidson County. May, June. Acorns ripe in October, November. Edible.

\***Q. Boyntoni** C. D. Beadle. n. sp. Common on Lookout Mt., near Gadsden, Ala. It very probably extends also on the Tennessee extension of Lookout Mt.

## ULMACEÆ Mirbel.

### ULMUS L.

**Ulmus Americana** L. White elm. A robust tree, attaining a height of 120 feet and 11 feet diameter. In rich and moist soil. O. S. March, April. Samaras maturing in May.

**U. racemosa** Thomas. Rock elm. Grows to a height of 100 feet by 4 feet diameter. In rich soil. Nashville.

**U. alata** Michx. Winged elm. Wahoo. A small tree. Very frequent in the glades of M. Tenn. March. Samaras ripe in April.

**U. fulva** Michx. Slippery elm. Tree attaining 70 feet by 2½ feet diameter. Hillsides and along streams. Bark mucilaginous, fragrant in drying. March, April. Fruit matures in April, May. *M.*

†**U. serotina** Sargent. Discovered in 1878 near grounds of Vanderbilt University. Flowering in October.

### PLANERA J. F. Gmelin.

**Planera aquatica** (Walt.) J. T. Gmelin. Planer tree. A small tree 40 feet high. Along water courses and in swamps. W. Tenn. Bridgeport. April, May.

\***Q. Boyntoni** C. D. Beadle. Shrub 1-5 m. tall, usually growing in large clumps, or a small tree, with short trunk less than 1 dm. in diameter; leaves, obovate in outline, 5-9 cm. long, 1.5-4 cm. broad, with from three to five small, obtuse lobes above the middle, cuneate from the lower lobes to the base, glabrous above, tomentose beneath; acorns, sessile or short pedunculate; nut, oval or obovoid, 12 mm. high, 9-10 wide; cup, turbinate, inclosing less than one-half of the nut.

†**U. serotina** Sargent. Tree 40 to 50 feet high, 2 to 3 feet diameter of trunk, with close, pale-gray bark; leaves, oblong obovate, acuminate, variously oblique at the base, coarsely and doubly crenulate-serrate, membranaceous, glabrous and lustrous above, puberulous below on the prominent midribs and veins; flowers, perfect, autumnal, racemose, from buds in the axils of the leaves of the year, long-pedicellate; calyx, six-parted at the base, its divisions oblong-obovate, rounded at the apex; ovary, sessile, narrowed below, hirsute; samaras stipitate, oblong elliptical, deeply two-parted at the apex, ciliate on the margin; seeds, obovate, raphe conspicuous; young leaves, stipules and bracts unknown. (Botanical Gazette, February, 1899.)

### CELTIS L.

*Celtis occidentalis* L. Hackberry. Maximum height, 120 feet by 5 feet diameter. O. S. April, May. Fruit matures in September.

*C. Mississipiensis* Bosc. Shrubby, or a smaller tree, as the foregoing. In the dry glades of M. Tenn. April. A stunted form is *Celtis pumila* Pursh.

### MORACEÆ Lindl.

#### MORUS L.

*Morus rubra* L. Red mulberry. In rich soil. O. S. April, May. Fruit ripe in June.

*M. alba* L. White mulberry. Formerly used for feeding silk worms, and, therefore, imported. Sparingly escaped. May. Fruit matures in July, August.

#### TOXILON Raf. (Maclura Nut.)

*Toxilon pomiferum* Raf. A small tree indigenous to the Transmississippi region. Here planted for hedges, and occasionally spontaneous. May, June. Fruit matures in October.

#### BROUSSONETIA L'Her.

*Broussonetia papyrifera* (L.) Vent. A small dioecious tree, native of the South Sea Islands. Cultivated as a shade tree in Europe and America. All those in Nashville, with a single exception, are male. May, June. Fruit in September.

#### HUMULUS L.

*Humulus Lupulus* L. Hop. Sometimes found escaped from cultivation. July, August. Our climate is not congenial to hop culture. *M.*

#### CANNABIS L.

*Cannabis sativa* L. Hemp. In waste places, escaped from cultivation or scattered from bird cages. Native of Europe and Asia. July-September. *M.*

### URTICACEÆ Reichenb.

#### URTICA L.

*Urtica dioica* L. Stinging nettle. Frequently introduced, but not naturalized in Tennessee. June, July.

*U. gracilis* Ait. Along fence rows in the mountains of E. Tenn. May, June.

*U. urens* L. The burning nettle. In waste places in towns

where imported goods are unpacked. Does not get naturalized. April.

*U. chæmædryoides* Pursh. In thickets. Frequent around Nashville. April.

#### URTICASTRUM Fabr. (*Laportea* Gaud.)

*Urticastrum divaricatum* (L.) Kuntze. Wood nettle. In rich woods. O. S. July, August.

#### ADICEA Raf. (*Pilea* Lindl.)

*Adicea pumila* (L.) Raf. *Pilea pumila* A. Gray. Rich weed. In moist situations, on rotten wood. O. S. July-September.

#### BÆHMERIA Jacq.

*Bœhmeria cylindrica* (L.) Willd. False nettle. In moist soil. O. S. July.

*B. nivea* Hooker & Arnott. Introduced from Eastern Asia, and, as reported, growing well in W. Tenn.

#### PARIETARIA L.

*Parietaria Pennsylvanica* Mühl. Pellitory. In waste ground, edge of woodlands. O. S. June, July.

#### LORANTHACEÆ DC.

##### PHORADENDRON Nutt.

*Phoradendron flavescens* (Pursh.) Nutt. American mistletoe. Parasitic on all deciduous-leaved trees. May-July. Fruit matures in December.

#### SANTALACEÆ R. Br.

##### COMANDRA Nutt.

*Comandra umbellata* (L.) Nutt. Bastard toad flax. Parasitic on roots of various plants. In the oak barrens of Tullahoma. April-June.

#### PYRULARIA Michx.

*Pyrularia pubera* Mich. *P. oleifera* A. Gray. Oil nut. Buffalo nut. Alleghany and Cumberland Mts. May. Fruit ripe in August.

#### BUCKLEYA Torr.

*Buckleya distichophylla* Torr. Along the road from Wolf Creek to Hot Springs, N. C. Along French Broad River. May.

## ARISTOLOCHIACEÆ Blume.

## ASARUM L.

*Asarum Canadense* L. Wild ginger. Woodlands. O. S. Banks of Cumberland River at Nashville. April, May. *M.*

*A. Virginicum* L. Cumberland and Alleghany Mts. May, June.

*A. macranthum* (Shuttlw.) Small. Valley of Ocoee River at Parksville. May.

*A. arifolium* Michx. Mts. of E. Tenn. April-June.

*A. Ruthii* Ash. n. sp. Hiwassee Valley. A. Ruth.

## ARISTOLOCHIA L.

*Aristolochia Serpentaria* L. Virginia snake root. Bluffs along Cumberland River, Nashville. E. and M. Tenn. June, July. Fruit in September. *M.*

*A. macrophylla* Lam. A. Siph. L'Her. Dutchman's pipe. Mts. of E. Tenn. Along Doe River. May, June. Fruit ripe in September.

*A. tomentosa* Sims. Valley of Cumberland River. May, June. Fruit in August.

## POLYGONACEÆ Lindl.

## RUMEX L.

*Rumex Acetosella* L. Sheep sorrel. In dry fields. O. S. May-September. *M.*

*R. verticillatus* L. Swamp dock. Swamps along Cumberland River. July, August.

*R. altissimus* Wood. R. Britannica Meisson. Moist ground or ditches. O. S. April, May.

*R. crispus* L. Curled dock. Native from Europe. O. S. June-August. *M.*

*R. conglomeratus* Mun. Waste places. Nashville. May-July.

*R. obtusifolius* L. Bitter dock. O. S. Naturalized from Europe. June-August.

## FAGOPYRUM Gaut.

*Fagopyrum Fagopyrum* (L.) Karst. *F. esculentum* Mœnch. Buckwheat. Frequently cultivated on the Cumberland Plateau, and persistent in fields after cultivation. June, July.

## RHEUM L.

*Rheum palmatum* L. Rhubarb.

*Rh. compactum* L., with their varieties, are important products of the market gardens.

## POLYGONUM L.

*Polygonum emersum* (Michx.) Britton. *P. Mühlenbergii* S. Watson. River swamps. Wild-goose pond near Mitchellville. July-September.

*P. incarnatum* Ell. In wet soil. O. S. June-September.

*P. lapathifolium* L. Waste places. O. S. June-September.

*P. Pennsylvanicum* L. In moist soil. O. S. July-September.

*P. Persicaria* L. Lady's thumb. Waste and wet ground. O. S. June-October.

*P. hydropiperoides* Michx. Mild water pepper. Inundated ground. O. S. June-September.

*P. Hydropiper* L. Smart weed. In moist waste places. O. S. July-September.

*P. punctatum* Ell. *P. acre* H. B. K. Water smart weed. Ponds and ditches. O. S. June-October. *M.*

*P. orientale* L. Prince's feather. Escaped from gardens. O. S. August, September.

*P. Virginianum* L. Virginia knot weed. Thickets. O. S. July-November.

*P. aviculare* L. Knot-door weed. In all yards and roadsides. O. S. June-October.

*P. erectum* L. Frequently in company with *P. aviculare* L. O. S. July-September.

*P. tenue* Mich. Cumberland Plateau. Sewanee. July-September.

*P. Convolvulus* L. Black bind weed. Waste and cultivated grounds. Nashville. July-September.

*P. dumetorum* L. Hedge buckwheat. Vicinity of Knoxville. July-September.

*P. scandens* L. Thickets. O. S. August, September.

*P. cristatum* Engelm. Climbing high. Harpeth hills, south of Nashville. August-October.

*P. sagittatum* L. Arrow-leaved tear thumb. Swampy lands. O. S. July-September.

*P. arifolium* L. Cumberland Plateau. September.

## BRUNNICHIA Banks.

*Brunnichia cirrhosa* Bank. Grounds of the Tennessee Hospital for the Insane, near Nashville, around the fountain. Also W. Tenn. May, June.

## CHENOPODIACEÆ Dumort.

## CHENOPODIUM L.

*Chenopodium album* L. Lamb's quarters. Pig weed. Cul-

tivated grounds. O. S. June-September. Naturalized from Europe.

**Ch. glaucum** L. Goosefoot. W. Tenn. June-September. Naturalized.

**Ch. polyspermum** L. Knoxville. July-September.

**Ch. Boscianum** Mag. Fields and woods. O. S. July-September.

**Ch. urbicum** L. Streets of Chattanooga. Adventive from Europe. June-September.

**Ch. murale** L. Naturalized from Europe. In towns and settlements. O. S. June-September.

**Ch. Botrys** L. Jerusalem oak. Cultivated in gardens for its fragrantcy, and naturalized from Europe. O. S. July-September. *M.*

**Ch. ambrosioides** L. Mexican tea. Naturalized from tropical America. In waste grounds. Brownsville, W. Tenn. August-October.

**Ch. anthelminticum** L. Wormseed. Naturalized from Europe. Abundant. O. S. *M.*

#### BETA L.

**Beta vulgaris** L. Beet. Cultivated in numerous varieties, including the sugar beet. A native of Southern Europe, and already cultivated by the Romans.

**B. Cicla** L. White or Sicilian beet, native of Sicily, including a variety called Swiss chard beet, are favorite vegetables, and the blanched and sliced leaves and midribs are served as salads.

**B. maritima** L. The sea beet or mangold wurzel, a native of Britain and Southern Europe, are excellent food material for cattle; and, moreover, from the brilliant tints of their leaves, very decorative plants.

#### SPINACIA L.

**Spinacia oleracea** L. Of unknown nativity; is an esteemed, much-cultivated pot herb; only found in cultivation, although cultivated over three hundred years.

#### AMARANTHACEÆ J. St. Hil.

##### AMARANTHUS L.

**Amaranthus retroflexus** L. Common weed, naturalized from Europe. August-October.

**A. hybridus** L. Naturalized from tropical America. O. S. August-October.

**A. spinosus** L. Naturalized from tropical America. Very

copious in the streets and vacant town lots in Nashville. June-September.

**A. hybridus paniculatus** L. and **A. hypochondriacus** L. Frequent in gardens, known as "princess feather;" often escapes into waste grounds.

### ACNIDA L.

**Acnida tamariscina** (Nutt.) Wood. Western water hemp. Var. *tuberculata* Mag. Abounds as a troublesome weed in fields near Nashville. July-September.

### FRÆHLICHIA Mœnch.

**Frœhlichia Floridana** (Nutt.) Mag. According to Illustrated Flora, belongs to Tennessee. June-September.

### IREFINE P. Br.

**Iresine paniculata** (L.) Kuntze. *I. celosioides* L. River banks and adjoining fields near Nashville. August, September.

### PHYTOLACCÆÆ Lindl.

#### PHYTOLACCA L.

**Phytolacca decandra** L. Poke root. Frequent in woodlands and cultivated grounds. O. S. July-October. Berries ripe in October. Also called "inkberry."

### NYCTAGINACEÆ Lindl.

#### ALLIONIA Lœfl. (*Oxybaphus* L'Her.)

**Allionia albida** Watt. Umbrella wort. *Oxybaphus albidus* Chaisy. Cliffs along Cumberland River at Nashville. May-August.

**A. nyctaginea** Michx. *Oxybaphus nyctagineus* Sweet. W. Tenn. Guthrie. May-August.

### AIZOACEÆ A. Br.

#### MULLUGO L.

**Mollugo verticillata** L. Carpet weed. In waste and cultivated grounds, a weed. O. S. May-September.

### PORTULACACEÆ Reichenb.

#### TALINUM Adans.

**Talinum teretifolium** Pursh. Crevices in the limestone rocks, in the cedar glades. Frequent. July, August.

## CLAYTONIA L.

*Claytonia Virginica* L. Spring beauty. Woods and pastures. O. S. March-May.

*C. Virginica graminifolia*. Leaves narrowly linear, elongated. Hills around Nashville. March, April.

*C. Caroliniana* Michx. Mts. of E. Tenn. May, June.

## PORTULACA L.

*Portulaca oleracea* L. Purslane. Common garden weed. O. S. June, July.

*P. retusa* Engelm. Among the former and in the cedar glades. June.

*P. pilosa* L. Now and then in E. Tenn., Meigs County.

*P. grandiflora* Hook. Garden portulaca. Escaped from cultivation. Native of South America. July.

## TETRAGONIA DC.

*Tetragonia expansa* Fenzl. New Holland spinach. Cultivated only for the table. A native of Tasmania.

## CARYOPHYLLACEÆ Reichenb.

## AGROSTEMMA L.

*Agrostemma Githago* L. Corn cockle. In grain fields and waste places. O. S. July-September.

## SILENE L.

*Silene stellata* (L.) Aiton. Starry champion. Open woodlands. O. S. June, July.

*S. Caroliniana* Walt. S. Pennsylvanica Michx. Cumberland and Alleghany Mts. April-June.

*S. Virginica* Link. Fire pink. Sunny hillsides. O. S. May, June.

*S. rotundifolia* Nutt. Catchfly. High cliffs of Cumberland Mts. Lookout Mt. June, July.

*S. regia* Sims. Lake Ottose, near Knoxville. A. Ruth. July.

*S. antirrhina* L. Waste places, rocky soil. O. S. April-June.

*S. ovata* Pursh. Lemon's Gap, Cocke County. T. H. Kearney. June.

*S. alba* Mühl. White champion. Near Wartburg, Morgan County. June.

## SAPONARIA L.

*Saponaria officinalis* L. Soap wort. O. S. Naturalized from Europe. July, August. *M.*

## DIANTHUS L.

*Dianthus Armeria* L. Pink. River banks at Marion, S. W. Va. Adventitious from Europe. J. K. Small.

ALSINE L. (*Stellaria* L.)

*Alsine media* L. *Stellaria media* Cyr. Common chick weed. Waste places. O. S. Naturalized from Europe. January-December. M.

*A. pubera* (Michx.) Britton. *Stellaria pubera* Michx. Great chick weed. Rich woodlands. O. S. April, May.

*A. longifolia* (Mühl.) Britton. *Stellaria longifolia* Mühl. Stickwood. Low grounds, Kingston Springs. May.

*A. fontinalis* (Short & Peter) Britton. In wet places, in the glades. Frequent in the vicinity of Nashville. April, May.

*A. prostrata*. *Stellaria prostrata* Baldw. Knoxville. A. Ruth.

## CERASTIUM L.

*Cerastium viscosum* L. Mouse-ear chick weed. Meadows and waste places. O. S. April.

*C. vulgatum* L. Pastures and roadsides. O. S. March-May.

*C. longipedunculatum* Mühl. *C. nutans* Raf. Moist grounds and hillsides. O. S. May, June.

*C. arvense* L. Knoxville. A. Ruth.

*C. oblongifolium* Torr. *C. arvense oblongifolium* Holt. & Britton. Moist, shady banks, growing in tufts. Nashville. April, May.

## SAGINA L.

*Sagina decumbens* (Ell.) Torrey & Gray. Pearl wort. Damp and dry soil. On pavements. Nashville, Knoxville. March-May.

ARENARIA L. (*Alsine* Wahl.)

*Arenaria serpyllifolia* L. Sandwood. Dry, rocky ground. O. S. March, April.

\**A. patula* Michx. *A. Pitcheri* Nutt. Limestone regions of M. Tenn. Nashville, Knoxville. April, May.

*A. Groenlandica* (Retz.) Spreng. *A. glabra* Michx. High-

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\**A. patula* Michx. Type, as I understand it, has corolla expanded to 15 mm. and ripe capsule exceeding calyx lobes by one-third. There is a variety occurring in the same region with expanded flowers only 5-7 mm., other proportions equal to former, and the testa marked with the same beautiful design like the former *A. patula tenella*.

est points of Alleghany and Cumberland Mts. June-September.

*A. diffusa* Ell. Bluffs on Mill Creek. Copses near Pulaski. June.

### PARONYCHIA Adans.

*Paronychia argyrocoma* (Michx.) Nutt. Whitlow wort. Higher Cumberland and Alleghany Mts. Black Mts., above Piney. Mrs. J. Bennett. July.

*P. dichotoma* (L.) Nutt. Mts. of E. Tenn., near Ducktown. July-October.

### ANYCHIA Michx.

*Anychia dicitotoma* Michx. Chick weed. Dry woods and thickets O. S. May-September.

*A. Canadensis* (L.) B. S. P. *Anychia capillacea* DC. With the former, and often on the same square foot of ground. Hills south of Nashville. O. S. June-September.

### SCLERANTHUS L.

*Scleranthus annuus* L. Knewel. Waste grounds. Nashville. March-September.

### NYMPHAEACEÆ DC.

#### CABOMBA Aubl.

*Cabomba Caroliniana* A. Gray. Carolina water shield. Cypress swamps, W. Tenn. May-August.

#### BRASENIA Schreb.

*Brasenia purpurea* (Michx.) Casp. *B. peltata* Pursh. Water shield. Lagoons along Tennessee River. Ponds in Sumner County. May-August.

#### NYMPHÆA. L.

*Nymphæa advena* Soland. Nuphar advena R. Br. Yellow pond lily. In ponds and slow streams. O. S. April-September. *M.*

#### CASTALIA Salisb.

*Castalia odorata* (Dryand.) Woodf. & Wood. White water lily. In ponds and lagoons along rivers. O. S. Pond in lunatic asylum near Nashville. June-September. *M.*

#### NELUMBO Adans.

*Nelumbo lutea* (Willd.) Pers. American Nelumbo. Wa-

ter chinquapin. Lagoons and ponds, M. and W. Tenn. Nashville. Very frequent. June-September.

### CERATOPHYLLACEÆ A. Gray.

*Ceratophyllum demersum* L. Hornwort. In ponds and stagnant water. O. S. June, July.

### MAGNOLIACEÆ J. St. Hil.

#### MAGNOLIA L.

*Magnolia Fraseri* Walt. Slopes of the Smoky Mts. June, July.

*M. macrophylla* Michx. Large-leaved umbrella tree. Alleghanies. Cumberland Mts., near Rugby. J. F. James.

*M. tripetala* L. Umbrella tree. Cumberland and Alleghany Mts. June.

*M. Virginiana* L. *M. glauca* L. Sweet bay. Madison County, W. Tenn. S. M. Bain. May, June.

*M. acuminata* L. Cucumber tree. Rich soil, river bottoms. O. S. May, June.

*M. grandiflora* L. In cultivation only.

#### LIRIODENDRON L.

*Liriodendron Tulipifera* L. Yellow poplar. O. S. Attaining to a height of from 100 to 190 feet by from 4 to 12 feet diameter. Most frequent in the Mississippi bottoms, where it grows to greatest size. May, June. *M.*

### ANONACEÆ DC.

#### ASIMINA Adans.

*Asimina triloba* (L.) Dunal. Papaw. A shrub or tree reaching from 20 to 40 feet in the river bottoms. Flowering in March; fruit maturing in October.

### RANUNCULACEÆ Juss.

#### HYDRASTIS Ellis.

*Hydrastis Canadensis* L. Golden seal. Yellow puccoon. Open woodlands and rich soil. O. S. Various places around Nashville. April, May. *M.*

#### CALTHA L.

*Caltha palustris* L. Marsh marigold. Boggy mountain meadows. Ducktown. April-June.

**COPTIS** Salisb.

*Coptis trifolia* (L.) Salisb. Gold thread. Higher Alleghenies. Summit of Thunderhead. At the edge of laurel thickets. Very abundant. Piney Creek, in Rhea County. Mrs. Lydia A. Bennett. May-July. *M.*

**XANTHORRHIZA** L'Her.

*Xanthorrhiza apiifolia* L'Her. Yellow root. Shady banks of mountain streams in the Cumberland and Alleghany Mts. April, May. *M.*

**ACTÆA**. L.

*Actæa rubra* (Ait.) Willd. Red baneberry. Moist woods. O. S. April-June. *M.*

*A. alba* (L.) Mill. White baneberry. Same range with the former. O. S. April-June. *M.*

**CIMICIFUGA** L.

*Cimicifuga racemosa* (L.) Nutt. Black snake root. Woods. O. S. June-August. *M.*

*C. cordifolia* Pursh. Bluffs along Tennessee River at Knoxville. A. Ruth. T. H. Kearney. *C. rubifolia* Kearney n. sp. seems to be identical with *cordifolia* Pursh.

*C. Americana* Michx. American bugbane. Big Frog Mts. Roane Mt. Chickering. August, September.

**AQUILEGIA** L.

*Aquilegia Canadensis* L. Columbine. Rocky woods. O. S. April-June.

*A. coccinea* Small. ined. Rich soil. Knoxville. A. Ruth.

**DELPHINIUM** L.

*Delphinium urceolatum* Jacq. *D. exaltatum* Ait. Tall larkspur. Roane Mt. J. W. Chickering. July, August.

*D. Consolida* L. Knight's spur. Larkspur. Waste grounds, old fields. O. S. Naturalized from Europe. July.

*D. Carolinianum* Walter. *D. azureum* Michx. Rocky places. Frequent about Nashville. May, June.

*D. tricornis* Michx. Edge of woodlands in rich soil. O. S. April, May.

**ACONITUM** L.

*Aconitum uncinatum* L. Monk's hood. Lake Otosee, near Knoxville. A. Ruth. June.

*A. reclinatum* A. Gray. Wolf's bane. Mts. of E. Tenn. July.

**ANEMONE L.**

*Anemone Caroliniana* Walt. Cedar glades of M. Tenn. Lavergne. April, May.

*A. cylindrica* A. Gray. Alleghanies, near Ducktown. June-August.

*A. Virginiana* L. Woods. O. S. June-August.

*A. trifolia* L. Little Frog Mt., with *Convallaria majalis*. April.

*A. quinquefolia* L. *A. nemorosa* var. *quinquefolia* A. Gray. *A. nemorosa* of eleventh edition of Tennessee Flora. Wind flower. Paradise Ridge, Davidson County. April, May.

**HEPATICA L.**

*Hepatica Hepatica* (L.) Karst. Liverwort. In the Big Frog Mts., E. Tenn., it occurs with obtuse and acute leaves from the same root. March. M.

*H. acuta* (Pursh.) Britton. Hills and woodlands of M. Tenn. March, April.

**SYNDESMON Hoffmg.**

*Synthesmon thalictroides* (L.) Hoffmg. Rue *Anemone Anemonella thalictroides* Spach. O. S. March, April.

**CLEMATIS L. (Anemonella Spach.)**

*Clematis Virginiana* L. Virgin's bower. O. S. July, August.

*C. Addisonii* Britton. Cliffs on Cumberland River above Nashville. Sequatchie Valley. Mrs. Lydia S. Bennett.

*C. ochroleuca* Ait. Mts. of E. Tenn. Roanoke, S. W. Va. J. K. Small. May, June.

*C. Viorna* L. Leather flower. O. S. May-July.\*

*C. Gattingeri* J. K. Small. n. sp. Bluffs on Cumberland River above Nashville. June.

*C. reticulata* Walter. Bluffs of Cumberland River at Nashville. May, June.

**ATRAGENE L.**

*Atragene Viticella* L. Since many years cultivated in gardens in Nashville, and hence escaped into hedges. May. *C. Viticella* L.

**MYOSURUS L.**

*Myosurus minimus* L. Mouse tail. In moist places, old race track, Nashville. April.

**TRAUTVETTERIA F. & M.**

*Trautvetteria Carolinensis* Walt. *T. palmata* F. & M.

Throughout the Alleghanies and at the Piney Falls, in the Cumberland Mts. Mrs. L. F. Bennett. June, July.

### RANUNCULUS L.

*Ranunculus hispidus* Michx. Water crowfoot. Low grounds, five miles from Knoxville. A. Ruth.

*R. pusillus* Poir. Ditches and waste grounds. O. S. April, May.

*R. oblongifolius* Ell. Damp ground. Tullahoma. Paradise Ridge, Davidson County. April.

*R. obtusiusculus* Raf. *R. alismæfolius* A. Gray. Ponds along Cumberland River. June-August.

*R. abortivus* L. O. S. April-June.

*R. sceleratus* L. In ditches, E. Tenn. April-August.

*R. recurvatus* Poir. Hooked crowfoot. In woods. O. S. April-June.

*R. bulbosus* L. Knoxville. A. Ruth. May-July.

*R. septentrionalis* Poir. Marsh buttercup. O. S. April-July.

*R. fascicularis* Mühl. Fields and pastures. O. S. March-May.

*R. parviflorus* L. Naturalized from Europe. O. S. April-July.

### BATRACHIUM S. F. Gray. (*Ranunculus* L.)

*Batrachium trichophyllum* (Chaix.) Bossh. *Ranunculus aquatilis* var. *trichophyllum* DC. Ponds along Cumberland and Tennessee Rivers. June-September.

*B. divaricatum* (Schrank.) Wimmer. *Ranunculus divaricatus* Schrank. In pools and on the mud on river banks. O. S. June, July.

### THALICTRUM L.

*Thalictrum clavatum* DC. Meadow rue. Cumberland and Alleghany Mts., in irrigated places. May, June.

*T. dioicum* L. In woods in the mountains and on the high lands. O. S. April, May.

*T. caulophylloides* J. K. Small. Cove Mt. Prof. Ruth. July.

*T. coriaceum* (Britt.) Small. Mts. of E. Tenn. Ducktown. White Rock Mt., S. W. Va. J. K. Small. May, June.

*T. purpurascens* L. *T. purpurascens* var. *ceriferum* Aust. O. S. July.

*T. polygamum* Mühl. *T. Cornuti* T. & G. Tall meadow rue. Moist woodlands. O. S. John Overton's farm, Nashville. June-August.

## BERBERIDACEÆ T. &amp; G.

## BERBERIS L.

*Berberis Canadensis* Mill. Barberry. Waters of Holston River. J. K. Small. May, June.

*B. Aquifolium* Pursh. Mahonia repens Don. Frequently cultivated in gardens. Native of Rocky Mts. April, May. Escaped.

## CAULOPHYLLUM Michx.

*Caulophyllum thalictroides* (L.) Michx. Blue cohosh. Papoose root. Rich woodlands. O. S. April, May. *M.*

## DIPHYLLEIA Michx.

*Diphylleia cymosa* Michx. Umbrella leaf. Smoky Mts. Roane Mt. Chickering. May, June.

## JEFFERSONIA Bart.

*Jeffersonia diphylla* (L.) Pers. Twin leaf. Rocky woodlands. O. S. Also called "rheumatism root." April, May.

## PODOPHYLLUM L.

*Podophyllum peltatum* L. May apple. Wild mandrake. Low woods. O. S. May. *M.*

## MENISPERMACEÆ DC.

## CALICOCARPUM Nutt.

*Calicocarpum Lyoni* (Pursh.) Nutt. Cupseed. River bottoms, climbing high. May, June. Fruit ripe in August.

## CEBATHA Forsk. (Cocculus DC.)

*Cebatha Carolina* (L.) Britton. Cocculus Carolinus DC. Dry uplands, as well as river bottoms. O. S. June. Berries ripe in September.

## MENISPERMUM L.

*Menispermum Canadense* L. Moon seed. Bottom lands. O. S. June, July. *M.*

## CALYCANTHACEÆ Lindl.

## BUTTNERIA Duham. (Calycanthus L.)

*Buttneria florida* (L.) Kearney. Calycanthus floridus L. Strawberry shrub. Harpeth hills, south of Nashville. Kingston Springs. Also frequently cultivated in gardens. April-August.

*B. fertilis* (Walt.) Kearney. *Calycanthus lævigatus* Willd. *Calycanthus glaucus* Willd. Cumberland and Alleghany Mts. Fruit poisonous to sheep. August, September.

#### LAURACEÆ Lindl.

##### SASSAFRAS Nees & Eberm.

*Sassafras Sassafras* (L.) Karst. *Sassafras officinale* Nees. *Sassafras*. A small to a large tree. On the islands of Hiwassee and Tennessee Rivers, it reaches an altitude of from 100 to 120 feet by 5 feet diameter. April, May. Fruit matures in July, August. *M.*

##### MALAPCENA Adans. (*Tetranthera* Nees.)

*Malapœna geniculata* (Walt.) Coulter. *Tetranthera geniculata* Nees. Pond spice. In swamps on Cumberland Mts. East of Ducktown, in North Carolina. March, April.

##### BENZOIN Fabr. (*Laurus* L.)

*Benzoin Benzoin* (L.) Coulter. Spice bush. O. S. Banks of Cumberland River at Nashville. March, April. Fruit matures in August, September. *M.*

*B. melissæfolium* (Walt.) Nees. Not so frequent like the former. Cumberland Plateau. March.

#### PAPAVERACEÆ B. Juss.

##### PAPAVER L.

*Papaver somniferum* L. Occasionally on waste grounds, escaped from gardens. June-August. Source of opium.

*P. dubium* L. Waste grounds. Unfrequent. Adventitious from Europe. Summer.

##### ARGEMONE L.

*Argemone Mexicana* L. Prickly poppy. In some streets of Nashville. June-September.

*A. alba* Lestib. Is perhaps only a variety of the former, and grows promiscuously in same locality. June, July.

##### SANGUINARIA L.

*Sanguinaria Canadensis* L. Blood root. In rich woodlands. O. S. April, May. *M.*

##### STYLOPHORUM Nutt.

*Stylophorum diphyllum* (Michx.) Nutt. Celandine poppy. Woods, vicinity of Nashville. March-May.

**CHELIDONIUM L.**

**Chelidonium majus** L. Celandine. Adventitious from Europe. Knoxville. A. Ruth. *M.*

**BICUCULLA** Adans. (*Dicentra* Bernh.)

**Bicuculla Cucullaria** (L.) Millsp. *Dicentra Cucullaria* Torr. Dutchman's breeches. In leaf mold. Shady ravines. Harpeth hills, near Nashville. April, May.

**B. Canadensis** (Goldie.) Millsp. *Dicentra Canadensis* Walp. Squirrel corn. Cumberland and Alleghany Mts. *M.*

**B. eximia** (Kerr.) Millsp. *Dicentra eximia* Torr. Doe River, Carter County. Hiwassee Valley. A. Ruth. May-October.

**ADLUMIA** Raf.

**Adlumia fungosa** (Ait.) Greene. *A. cirrhosa* Raf. Climbing fumitory. Mts. of E. Tenn. Cranberry. June-October.

**CAPNOIDES** Adans. (*Corydalis* Vent.)

**Capnoides sempervirens** (L.) Bork. *Corydalis glauca* Pursh. Ravines on Doe River, Carter County. April-September.

**C. flavulum** (Raf.) Kuntze. *Corydalis flavula* Raf. Rocky woods. O. S. May, June.

**C. micranthum** Engelm. *Corydalis micrantha* A. Gray. Woods. O. S. May, June.

**FUMARIA L.**

**Fumaria officinalis** L. Fumitory. An abundant weed in fields in Europe; sometimes appearing here in vegetable gardens. June-August.

**CRUCIFERÆ** Bernh. Juss.**LEPIDIUM L.**

**Lepidium sativum** L. Garden pepper grass. Escaped from gardens. May-August.

**L. Virginicum** L. Wild pepper grass. In fields and along roadsides. O. S. May-November.

**L. apetalum** Willd. Naturalized from Europe. Here and there. O. S. May-July.

**CORONOPUS** Gaertn.

**Coronopus Coronopus** (L.) Karst. *Senebiera Coronopus* Poir. Vacant town lots, Memphis. Dr. Egeling. Naturalized from Europe. Summer.

**THLASPI L.**

*Thlaspi arvense* L. Field penny cress. In the grounds of market gardens, introduced with seeds. Summer.

**SISYMBRIUM L.**

*Sisymbrium officinale* L. Hedge mustard. Waste places. O. S. Introduced from Europe. May-November.

**SINAPIS L.**

*Sinapis alba* L. White mustard. Escaped from cultivation. Native of Europe. Summer.

**BRASSICA L.**

*Brassica nigra* (L.) Koch. Black mustard. In cultivation and escaped.

*B. arvensis* (L.) B. S. P. *Sinapis arvensis* L. Charlock. Wild mustard.

*B. campestris* L. Turnip. Cultivated in many varieties. Summer.

*B. Rapa* L. var. *depressa*. Flat-top turnip. In cultivation.

*B. Napus* L. Rape. Formerly cultivated for the oil of the seeds, but now abandoned.

*B. oleracea* L. Cabbage. Cultivated in many varieties. Summer.

**RAPHANUS L.**

*Raphanus sativus* L. Garden radish. Cultivated in many varieties, and sometimes spontaneous. Native of Asia. June-October.

*R. Raphanistrum* L. Appears sometimes as a garden weed, introduced with other seeds. "Jointed charlock." Summer.

**IODANTHUS Torr. & Gray.**

*Iodanthus pinnatifidus* (Michx.) Steudal. *Thelipadium pinnatifidum* S. Watson. Damp woodlands. O. S. May, June.

**RORIPA Scop. (Nasturtium R. Br.)**

*Roripa palustris* (L.) Bess. *Nasturtium palustre* DC. March water cress. Knoxville. A. Ruth. May-August.

*R. sessiliflora* (Nutt.) A. S. Hitchcock. *Nasturtium sessiliflorum* Nutt. Wet meadows and ditches. O. S. April-June.

*R. Nasturtium* (L.) Rusby. *Nasturtium officinale* R. Br. Water cress. In brooks and streams. O. S. Also sometimes cultivated. Naturalized from Europe. April-November. *M.*

*R. Armoracia* (L.) A. S. Hitchcock. *Nasturtium Armora-*

cia Fries. Horse-radish. Escaped from gardens into low grounds. Adventive from Europe. Summer.

**R. Americana** (A. Gray) Britton. *Nasturtium lacustre* A. Gray. Swamps along Tennessee and Cumberland Rivers. Summer.

### CARDAMINE L.

**Cardamine Pennsylvanica** Mühl. Bitter cress. On wet lands. O. S. April-June.

**C. arenicola** Britt. Moist, sandy soil. In Tennessee, according to Illustrated Flora. March, April.

**C. parviflora** L. *C. hirsuta* var. *parviflora* A. Gray. Dry woodlands. O. S. April, May.

\***C. Clematitis** Shuttlw. Summits of Smoky Mts. May-July.

**C. purpurea** (Torr.) Britton. *Arabis rhomboidea* var. *purpurea* Torr. Hiwassee Valley. A. Ruth. April, May.

**C. bulbosa** (Schreb.) B. S. P. *C. rhomboidea* DC. Low, wet ground. O. S. April.

**C. rotundifolia** Michx. Near Marion, S. W. Va. J. K. Small. May, June.

### DENTARIA L.

**Dentaria laciniata** Mühl. Pepper root. In moist, rich woods. O. S. March-May.

**D. diphylla** Michx. Shady ravines. O. S. Nashville. Banks of Cumberland River. April.

**D. heterophylla** Nutt. Woodlands. O. S. April.

**D. multifida** Mühl. E. Tenn. Cave Spring. March, April.

### LEAVENWORTHIA Torr.

**Leavenworthia uniflora** (Michx.) Britton. *L. Michauxii* Torr. Open, moist grounds. Nashville. Cedar glades. April, May.

**L. torulosa** A. Gray. Cedar glades, with the former. April, May.

†**L. stylosa** A. Gray. Cedar glades at Lavergne. All three often in close proximity. April, May.

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\**C. Clematitis* Shuttlw. Smooth; earliest leaves reniform, nearly entire; lower stem leaves broadly trilobed, the middle lobe larger, reniform-cordate, or angularly-trilobed; upper ones, oblong, three-lobed; petioles with an arrow-shaped appendage at the base; racemes, short, loose; petals, white, spatulate-obovate, twice as long as the calyx; silique, narrow-linear, compressed, tipped with the long style.

†*L. stylosa* Gray. Slender, stemless; silique, oval or broadly oblong (2 inches long), plain, surmounted by a slender style fully two inches in length; only from three to six seeds, orbicular, distinctly winged; embryo as in the preceding; petals, pure golden-yellow.

**LESQUERELLA** S. Watson.

*Lesquerella globosa* (Dew.) S. Watson. *Vesicaria Shortii* Torr. & Gray. Rising Sun Bluff, fourteen miles below Nashville, on Cumberland River. April, May.

*L. Lescurii* A. Gray. Covering whole fields and glades in the vicinity of Nashville. April, May.

**BURSA** Weber. (*Capsella* Med.)

*Bursa Bursa-pastoris* (L.) Britton. *Thlaspi Bursa-pastoris* L. Shepherd's purse. A common weed in fields and waste places. O. S. March-November. *M.*

**CAMELINA** Crantz.

*Camelina sativa* (L.) Crantz. False flax. Naturalized from Europe, where it is cultivated for the fine oil yielded by its seed. Scattering O. S.

**DRABA** L.

*Draba verna* L. Whitlaw grass. In fields and pastures. O. S. February-May.

*D. Caroliniana* Walt. Glades of M. Tenn. February-April.

*D. ramosissima* Desv. Cliffs on Ocoee River, Polk County. With *Saxifraga Tennessiensis*. April, May.

*D. brachycarpa* Nutt. Cedar glades of M. Tenn. March, April.

**SOPHIA** Adans.

*Sophia Sophia* (L.) Britton. *Sisymbrium Sophia* L. In fields and gardens. Naturalized from Europe. June, July.

*S. pinnata* (Walt.) Britton. *Sisymbrium canescens* Nutt. Knoxville. A. Ruth.

**STENOPHRAGMA** Celak. (*Sisymbrium* Gray.)

*Stenophragma Thaliana* (L.) Celak. *Sisymbrium Thaliana* Gay. Fields. O. S. Frequent in vicinity of Nashville. Introduced from Europe. April.

**ARABIS** L.

*Arabis Virginica* (L.) Trelease. A. Ludoviciana Meyer. Rock cress. Fields and pastures. O. S. March-May.

*A. lyrata* L. Rocky lands. O. S. Nashville. Banks of Cumberland River. Knoxville. A. Ruth.

*A. dentata* Torr. & Gray. Woodlands. O. S. April-June.

*A. patens* Sulliv. Bluffs on Ocoee River. Knoxville. A. Ruth.

*A. hirsuta* (L.) Scop. Cumberland Mts. May-September.

*A. lævigata* (Mühl.) Poir. On limestone cliffs along Cumberland River. April, May.

*A. Canadensis* L. Sickle pod. Rocky woodlands. O. S. April, May.

#### ERYSIMUM L.

*Erysimum cheiranthoides* L. Treakle mustard. Knoxville. A. Ruth. June-August.

#### KONIGA Adans. (Alyssum L.)

*Koniga maritima* (L.) R. Br. *Alyssum maritimum* Lam. Sweet alyssum. Escaped from gardens along fences. Nashville. Summer.

#### BERTEROA DC. (Alyssum L.)

*Berteroa incana* (L.) DC. *Alyssum incanum* L. Introduced and first observed in my garden in Nashville in June, 1897. June.

#### HESPERIS L.

*Hesperis matronalis* L. Dame's gilliflower. Introduced along a garden fence on Belmont Park, Nashville. May-June.

#### CAPPARIDACEÆ Lindl.

##### CLEOME L.

*Cleome spinosa* DC. *C. pungens* Willd. Spider flower. In waste places, river banks. O. S. Adventive from tropical America. Summer.

#### POLANISIA Raf.

*Polanisia graveolens* Raf. Along the track of the Nashville, Chattanooga and St. Louis Railway, in Dickson and Benton Counties. Foot of Fort Negley, South Nashville. Summer.

*Capparis spinosa* L. The caper ought to be introduced in cultivation, as it grows well under slight protection. Cult.

#### SARACENIACEÆ La Pyl.

*Saracenia purpurea* L. Pitcher plant. Low grounds along Mississippi, Tennessee, and Duck Rivers. April.

#### PODOSTEMACEÆ Lindl.

*Podostemon abrotanoides* Nutt. In all mountain streams of the Alleghany Mts. Submerged and on rocks. July-September.

*P. ceratophyllum* Michx. River weed. Streams in the Cumberland Mts. July-September.

## CRASSULACEÆ DC.

## SEDUM L.

*Sedum roseum* (L.) Scop. *S. Rhodiola* DC. Rose root. Roane Mt. Chickering.

*S. Telephium* L. Orpine. In a field near Bellvidere, Franklin County. Escaped from cultivation. June.

*S. telephioides* Michx. Mts. of E. Tenn. Chickering. June.

*S. acre* L. Wall pepper. Fountain Head, Sumner County, near a cabin. Adventitious, or escaped from cultivation. Native of Europe. June.

*S. pulchellum* Michx. Rocky and moist places, growing gregariously in patches, covering many acres. Prominently in the cedar glades. May.

*S. ternatum* Michx. Wild stone crop. Shady, rocky places, and among the grass. O. S. April, May.

*S. Nevii* A. Gray. On rocks throughout the Alleghany Mts. May, June.

## DIAMORPHA Nutt.

*Diamorpha pusilla* Nutt. On sandy flats, and on rocks in the Cumberland Mts. Abundant in Sewanee and on Lookout Mt.; covering the surface in "Rock City." May.

## PENTHORUM L.

*Penthorum sedoides* L. Virginia stone crop. Pools and ditches. O. S. July-September.

## SAXIFRAGACEÆ Dumort.

## ASTILBE Hamilt.

*Astilbe biternata* (Vent.) Britton. *As. decandra* D. Don. False goat's beard. Near water courses in the mountains of E. Tenn. June.

## SAXIFRAGA L.

*Saxifraga micranthidifolia* (Haw.) B. S. P. *S. erosa* Pursh. Rocks on Wolf Creek. Roane Mt. Chickering. May, June.

*S. Virginiensis* Michx. Rocky places. O. S. March-June.

*S. Tennesiensis* J. K. Small. Rocky bluffs on Tennessee River, above Knoxville. A. Ruth. T. H. Kinney. In the gorge of the Ocoee River, above Parksville. April, May.

*S. Michauxii* Britton. *S. leucanthemifolia* Michx. Roane Mt. Chickering. Big Frog Mt. June.

*S. Grayana* Britton. *S. Caroliniana* A. Gray. Walker Mt., S. W. Va. J. K. Small. June, July.

**S. Careyana** A. Gray. Roane Mt. Chickering. William Canby. July, August.

### Therofon Raf. (Boykinia Nutt.)

**Therofon aconitifolium** (Nutt.) Millsp. *Boykinia aconitifolia* Nutt. Throughout the Alleghanies, Ocoee and Doe Rivers, and in the Cumberland Mts. Piney Falls. Mrs. Lydia Bennett. July.

### TIARELLA L.

**Tiarella cordifolia** L. False mitrewort. E. Tenn. April, May.

### HEUCHERA L.

**Heuchera Rugelii** Shuttlw. Piney Falls. Cumberland Mts. Mrs. Lydia Bennett. July-September.

**H. villosa** Michx. Limestone rocks. M. Tenn. Frequent. June-September.

**H. Americana** L. Alum root. Vicinity of Nashville. May.

**H. pubescens** Pursh. Sewanee. Mts. of E. Tenn. May, June.

**H. macrorhiza** Small. n. sp. Frequent on limestone bluffs along Cumberland River and all the way along Louisville and Nashville Railroad to Pulaski. June, July.

### MITELLA L.

**Mitella diphylla** L. Mitrewort. Cumberland and Alleghany Mts. April, May.

### CHRYSOSPLENIUM L.

**Chrysosplenium Americanum** Schwein. Irrigated places in the Frog Mts. March-June.

### PARNASSIA L.

**Parnassia Caroliniana** Michx. Cumberland and Alleghany Mts. June-August.

**P. asarifolia** Vent. Big Frog Mts., E. Tenn. July-September.

### HYDRANGEA L.

**Hydrangea arborescens** L. Wild hydrangea. Highlands of M. Tenn. and river bluffs. June, July.

**H. arborescens Kanawhana** Millsp. *H. arborescens* var. *cordata* Gray. *H. cinera* J. K. Small. Bluffs on Ocoee River, above Parksville. June-September.

**H. radiata** Walt. Cataract near Tullahoma, and from there on up and through the Cumberland Mts.

**H. quercifolia** Bartram. Tullahoma. Barnes.

## DECUMARIA L.

*Decumaria barbara* L. Damp situations throughout the Alleghanies, clinging to rocks and bark of trees. May, June.

## PHILADELPHUS L.

*Philadelphus coronarius* L. Mock orange. Frequently cultivated in gardens, and hence found in deserted homesteads. May, June.

*Ph. hirsutus* Nutt. Bluffs on Cumberland River. Mts. of E. Tenn., Cocke County. Kearney. May.

*Ph. inodorus* L. Baker's Station to Ridgetop, Davidson County. May.

*Ph. grandiflorus* Willd. Knox County. A. Ruth. April, May.

## ITEA L.

*Itea Virginica* L. Mts. of E. Tenn. and cypress swamps of W. Tenn. May, June.

## GROSSULARIACEÆ Dumort.

## RIBES L.

*Ribes Cynosbati* L. Dogberry. At the edge of a cedar glade near Fosterville. Marion, S. W. Va. J. K. Small. April-June.

*R. gracile* Michx. Missouri gooseberry. Dry, rocky soil. Fide Illustrated Flora. May.

*R. rotundifolium* Michx. Summit of Roane and Thunderhead Mts. May-July.

*R. prostratum* L'Her. Fetid currant. Summit of White Top Mts., S. W. Va. J. K. Small. May, June.

*R. rubrum* L. Red currant. Cultivated, and sometimes escaped and seemingly spontaneous. Marion, S. W. Va. J. K. Small. April.

*R. aureum* Pursh. Buffalo currant. Has been for a long time in cultivation, and sometimes indicates old garden plots. May.

*R. Uva-crispa* L. *R. Grossularia* L. Garden gooseberry. Cultivated in gardens and temporarily existing in fence rows. Red currants and gooseberries do not prosper in Tennessee.

## HAMAMELIDACEÆ Lindl.

## HAMAMELIS L.

*Hamamelis Virginiana* L. Witch-hazel. A shrub, or sometimes a small tree. On the summit of Thunderhead (altitude,

6,000 feet) I found a regular grown tree, 25 feet high by 10 inches diameter of trunk. Flowers, Christmas time. Fruit in October.

### LIQUIDAMBAR L.

**Liquidambar Styraciflua** L. Sweetgum. Red gum. Large forest tree growing in wet or swampy lands. Very large, and frequent in the Tennessee and Mississippi bottoms. April, May.

### PLATANACEÆ Lindl.

#### PLATANUS L.

**Platanus occidentalis** L. Buttonwood. Plane tree. Sycamore. Attains the widest spread of crown of any of our timber trees. Reaches an altitude of 150 feet and diameter of trunk of 15 feet in our river bottoms. May.

### ROSACEÆ B. Juss.

#### OPULASTER Kuntze. (Neillia Brew.)

**Opulaster opulifolius** Kuntze. *Neillia opulifolia*. Brewer & Watson. Nine bark. Rocky places along Cumberland River. June.

#### SPIRAEA L.

**Spiraea salicifolia** L. Meadow sweet. Grand View, Rhea County. Miller's Cove, E. Tenn. June-August.

**S. tomentosa** L. Hardhack. Highlands of M. Tenn., in boggy localities. Fountain Head, Sumner County. July.

**S. corymbosa** L. S. W. Va. J. K. Small. July.

**S. Virginiana** Britton. Little River, E. Tenn. A. Ruth. June.

#### ARUNCUS Adans.

**Aruncus Aruncus** (L.) Karst. *Spiraea Aruncus* L. Goat's beard. Moist woodlands. O. S. Nashville, above water-works. May-July.

#### PORTERANTHUS Britt. (Gillenia Mœnch.)

**Porteranthus trifoliatus** (L.) Britton. *Gillenia trifoliata* Mœnch. Indian physic. Common in E. Tenn. May, June.

**P. stipulatus** (Mühl.) Britton. Prevailing in M. Tenn. woods. June, July.

#### RUBUS L.

**Rubus odoratus** L. High mountains of E. Tenn. Big Frog Mt. Valley of Ocoee River, above Parksville. June.

*R. strigosus* Michx. Wild red raspberry. Woods and copses. O. S. May, June.

*R. occidentalis* L. Black raspberry. O. S.

*R. villosus* Ait. Common blackberry. Bush blackberry. A white-fruited variety is found near Cleveland, E. Tenn.

*R. Alleghanensis* Port. *R. villosus* var. *montanus* Port. Mountains around Ducktown, E. Tenn.

*R. cuneifolius* Pursh. Gravelly hills. O. S. July, August.

*R. hispidus* L. Swamp blackberry. Lookout Mt. June.

*R. trivialis* Michx. Sandy soils. O. S. March-May.

*R. Baileyanus* Britt. *R. villosus* var. *humifusus*. Torr. & Gray. R. Britt. Hills around Marion, S. W. Va. J. K. Small.

*R. Canadensis* L. Dewberry. Dry soil. O. S. April, May. Fruit ripe in July.

### FRAGARIA L.

*Fragaria Virginiana* Duchesne. Scarlet strawberry. Dry uplands. O. S. April, May.

*F. vesca* L. European wood strawberry. Naturalized from Europe. Dry woodlands. O. S. April, May.

### DUCHESNEA J. E. Smith. (*Fragaria* Andr.)

*Duchesnea Indica* (And.) Focke. Waste places. Introduced from India. Old graveyard in Nashville. June, July.

### POTENTILLA L.

*Potentilla arguta* Pursh. Banks of Cumberland River, above waterworks, at Nashville. June.

*P. Monspeliensis* L. *P. Norvegica* L. Mts. of E. Tenn. Knoxville. A. Ruth. Foot of hills on White's Creek, Davidson County. July, August.

*P. paradoxa* Nutt. *P. supina* Michx. W. Tenn. Johnsonville and Hickman. June-September.

*P. fruticosa* L. Shrubby cinquefoil. Near Ducktown, in Turtletown, Cherokee County, N. C. June-September.

*P. tridentalis* Ait. Big Frog Mts., E. Tenn. June-August.

*P. Canadensis* L. Five finger. O. S. July-September.

### WALDSTEINIA Willd.

*Waldsteinia fragarioides* (Willd.) Tratt. Mts. of E. Tenn. Ocoee Valley. May, June.

\**W. parviflora* Small. Fide Illustrated Flora, Appendix. Ocoee Valley. June, July.

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\**W. parviflora* Small. Perennial by horizontal rootstocks; villose hirsute or glabrous in age; leaves, basal, from 5 to 12 inches high;

## GEUM L.

*Geum radiatum* Michx. Avens. Roane Mt. Chickering. July, August.

*G. vernum* (Raf.) Torr. & Gray. Shaded ground. O. S. March, April.

*G. Canadense* Jacq. *G. Album* Gmel. White Avens. Shaded places. O. S. **June-August.**

*G. Virginianum* L. Mountains and highlands. O. S. May-July.

*G. flavum* (Port.) Bicknell. *G. Canadense* Jacq. Var. *flavum* Britt. Woods along Wolf Creek, Cocke County. T. H. Kearney. Waters of Holston River, S. W. Va. J. K. Small. June.

## ULMARIA Hill.

*Ulmaria rubra* Hill. *Spiraea lobata* Gronov. Queen of the prairie. In a moist meadow, Cave Spring, Roane County. June, July.

*U. Ulmaria* (L.) Bernhart. *Spiraea Ulmaria* L. Escaped from gardens. Seen but one time near Nashville.

## ALCHEMILLA L.

*Alchemilla arvensis* (L.) Scop. Argentill. Fields near Knoxville. A. Ruth.

## AGRIMONIA L.

*Agrimonia hirsuta* (Mühl.) Bicknell. Mts. of E. Tenn. Tall agrimony.

*A. striata* Michx. *A. parviflora* DC. Glades of M. Tenn. July.

*Agrimonia mollis* (T. & G.) Britton. Mts. of E. Tenn. Slopes of White Top Mt., S. W. Va. J. K. Small.

*A. parviflora* Soland. O. S. July, August.

## SANGUISORBA L.

*Sanguisorba Canadensis* L. *Poterium Canadense* A. Gray. American burnet. Along Doe River, E. Tenn. Hiwassee Valley. A. Ruth.

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petioles, much longer than the blades, usually much less densely pubescent than the scapes; leaflets, cuneate, ovate, or broadly rhomboidal, from  $1\frac{1}{2}$  to 3 inches long, coarsely and irregularly crenate or lobed; scapes, erect, solitary, or several together, commonly shorter than the leaves, corymbose at top; calyx, usually hairy, the tube broadly turbinate, from  $1\frac{1}{4}$  to  $1\frac{1}{2}$  lines long, the segments triangular lanceolate or lanceolate-acuminate, often shorter than the tube; petals, linear-oblong or narrowly elliptical, shorter than the calyx segments or barely longer; achenes, obovoid,  $1\frac{1}{2}$  lines long.

## ROSA L.

*Rosa setigera* Michx. Prairie rose. Abundant in the glades of M. Tenn.

*R. setigera tomentosa* Gray. With the former. O. S. May-July.

*R. Carolina* L. Swamp rose. Low grounds and river swamps. O. S. June-August.

*R. humilis* Marsh. Pasture rose. Rocky slopes and glades. O. S. May-July.

*R. humilis lucida* Ehrh. Knoxville. A. Ruth.

*R. canina* L. Dog rose. E. Tenn. Vicinity of Marion, S. W. Va. J. K. Small. June.

*R. rubiginosa* L. Sweet brier. Roadsides and old fields. O. S. Naturalized from Europe. June, July.

*R. bracteata* Wendel. Old homesteads and hedges. Nolensville Pike, six miles south of Nashville. June.

*R. pimpinellifolia* L. Old homestead, Davidson County, Colonel Prosser's farm. Introduced by early settlers. June, July.

## SORBUS L.

*Sorbus Americana* Marsh. American mountain ash. Summit of Thunderhead. Smoky Mts. Small tree. May, June.

## PYRUS L.

*Pyrus communis* L. Pear. In cultivation only. In many varieties. Native of Eurasia. April.

## MALUS Juss.

*Malus angustifolia* (Ait.) Michx. *Pyrus angustifolia* Ait. Narrow-leaved crab apple. Small tree, from 15 to 20 feet high. O. S. In limestone regions. March-May.

*M. coronaria* L. *Pyrus coronaria* L. American crab apple. Upper E. Tenn. South fork of Holston River. J. K. Small. Cultivated in some gardens. March. Fruit matures in September.

*Malus Malus* (L.) Britton. *Pyrus Malus* L. Apple. Native of Europe and Asia. Sometimes spontaneous, and cultivated in many varieties.

## ARONIA Pers.

*Aronia arbutifolia* (L.) Ell. *Pyrus arbutifolia* L. Red chokeberry. Mountain bogs in the Cumberland and Alleghany Mts. March-May.

*A. nigra* (Willd.) Britton. Black chokeberry. Laurel thickets in the Cumberland and Alleghany Mts. Sewanee. March-June.

## CYDONIA L.

*Cydonia vulgaris* Pers. Quince. Native of E. Europe and the Levante. In cultivation only. April.

*C. Japonica* Pers. *Pyrus Japonica* L. Frequently cultivated as an ornamental shrub. Sometimes found as a straggler. Fruit very fragrant. February, March. Fruit in September, October.

## AMELANCHIER Med.

*Amelanchier Canadensis* (L.) Med. Service berry. Extending from the high mountains to the valleys of E. Tenn. March-May. Fruit in June, July.

*A. Botryapium* (L. f.) DE. *A. Canadensis* var. *oblongifolia*. T. & G. Same range with the former. April, May.

## CRATÆGUS.\*

*Cratægus Crus Galli* L. Cockspur thorn. O. S. May.

*C. punctata* Jacq. *C. tomentosa* var. *punctata* A. Gray. Summit of Roane Mt.

*C. cordata* Ait. Washington thorn. Rocky glades around Nashville. May.

*C. viridis* L. *C. arborescens* Ell. April. Jackson. Hollow Rock.

*C. rotundifolia* Bork. *C. glandulosa* Willd. Marion, S. W. Va. J. K. Small. April-June.

*C. mollis* (T. & G.) Soheele. *C. tomentosa* var. *mollis*. Gray. From 15 to 20 feet high. Nashville. April, May.

*C. tomentosa* L. Nashville. Tree from 12 to 15 feet high. May, June.

*C. tomentosa Chapmani* Beadle. M. Tenn.

*C. uniflora* Mœnch. Dwarf thorn. Wolf Creek. T. H. Kearney. Lookout Mt. Knoxville. A. Ruth. April.

†*C. Biltmoreana* Beadle. E. Tenn. Shrub from 1 to 5 feet high. Legit Beadle.

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\*The genus *Cratægus* has been revised from notes received from C. D. Beadle, curator of the Biltmore Herbarium, as represented in said collection.

†*C. Biltmoreana* Beadle. Flowers appearing when the leaves are nearly fully grown in 3-7 flowered corymbs, with lanceolate, pectinately glandular caducous bracts on strict, pubescent pedicels; calyx, pubescent, obconic; petals, broadly obovate or orbicular; stamens, 10, shorter than the petals; styles, 3-5; fruit maturing in September, October; depressed globose, bluntly angled, 10-15 mm. broad, 10-12 mm. high, containing 3-5 nutlets; leaves, 2-5 cm. wide, 3-10 cm. long, including the petioles; ovate, acute at the apex, wedge-shaped at the base, and prolonged into a winged or margined petiole; border acutely incised or slightly 5-9 lobed and sharply and irregularly serrate near the base; spines, stout, 2-5 cm. long, slightly curved. (Vide Bot. Gazette, No. 6, December, 1899.)

\***C. Sargenti** Beadle. S. E. Tenn. Shrub from 2 to 6 feet high. April.

†**C. Boyntoni** Beadle. Tree or shrub. *C. rotundifolia*. Bork. E. Tenn. Marion, S. W. Va. J. K. Small. Small tree. April.

‡**C. Austro-Montana** Beadle. Cumberland Mts. E. and M. Tenn. May.

§**C. Harbisoni** Beadle. Discovered by T. G. Harbison on the hills near Nashville, 1899. May. Charlotte Pike, 1886, collected by the author.

\*\***C. Mohri** Beadle. Tree, 6-10 m. tall. Southern part of M. Tenn. May.

\***C. Sargenti** Beadle. Shrub or small tree, branches spreading armed with straight or curved spines, 2-7 cm. long, flowers appearing when the leaves are almost fully grown, in generally three-flowered corymbs; calyx, obconic, pubescent; segments, glandular-serrate; divisions of corolla nearly round; stamens, normally 20; pistils, 3-5; fruit mature at middle September; globose, 10-12 mm. high, orange yellow; nutlets, 3-5; leaves, thin, glabrous, with 5-7 pairs prominent veins; ovate, acute at apex, rounded or abruptly contracted at base, in a margined or winged petiole, irregularly and doubly serrate, and incisely lobed; stipules, linear or linear-lanceolate.

†**C. Boyntoni** Beadle. Shrub or small tree, flowering with the expanded leaves, produced in short glandular-bracteate 4-10 flowered corymbs; calyx, obconic, smooth; divisions, acute, glandular, serrate; petals, nearly orbicular, 9-12 mm. diameter; stamens, 10; pistils, 3-5; fruit, dull, yellowish green, depressed globose, angled, 10-14 mm. high, ripening in October; nutlets, 3-5; leaves, subcoriaceous with age, glabrous, with 4-7 pairs of veins, broadly ovate, acute at apex, rounded at the base, sharply serrate, serratures minutely gland-tipped; stipules, linear.

‡**C. Austro-Montana** Beadle. A straggling shrub, 1-4 m. in height; branches, unarmed; branchlets, pilose-pubescent or tomentose; flowers, large in 3-5 flowered corymbs; calyx, broad, obconic, pubescent; divisions, lanceolate; stamens, 10; pistils, 3-5; fruit (which ripens at end of September), large; globose, 12-15 mm. in diameter, bright red, containing 3-5 nutlets; leaves, orbicular, 3.5-12 mm. long, including the pubescent petioles, pubescent on both surfaces, with 5-7 pairs of veins.

§**C. Harbisoni** Beadle. Tree, 5-8 m. high; leaves, obovate or oval, 3-12 cm. long, including the petiole; acute at apex, roughly pubescent on the upper side, densely coated on the lower surface, dark green and lustrous above, pale below; borders, doubly and irregularly serrate; calyx, obconic, pubescent; stamens, normally 20; pistils, 3-5; fruit, large, red; globose, 10-13 mm. diameter; nutlets, 3-5; spines of the branches, 3-6 cm. long.

\*\***C. Mohri** Beadle. Leaves, cuneate-obovate, 2-7 cm. long, including the petioles; acute or rounded at the apex and contracted below into a winged petiole; sharply serrate to the middle; entire, or nearly so, at the base; stipules, linear, caducous; flowers in many-flowered corymbs, which are pubescent at flowering time; calyx, narrow, obconic; divisions of corolla, round, ovate, with undulate or erose borders; stamens, 20; fruit globose, 8-9 mm. diameter; nutlets, 3-5.

\**C. Aprica* Beadle. Large shrub. Sunny hillsides. M. Tenn. April.

†*C. rubella* Beadle. Shrub, 1-4 meter high. Flowers in April. Lookout Mt.

‡*C. sinistra* Beadle. Ined. West Nashville. Dry hills.

§*C. straminea* Beadle. Shrub 1 m. high. Lookout Mt. and adjacent valley of E. Tenn. April, May.

\*\**C. tetrica* Beadle. Hills about Nashville. May.

††*C. Buckleyi* Beadle. Tree 8 m. high, 1-2 dm. diameter. E. Tenn. May.

\**C. Aprica* Beadle. Leaves, thin, obovate-orbicular, 1.5-7 cm. long, including petiole, dentate or crenate-dentate and conspicuously glandular, more or less lobed near the acute apex; flowers, borne in 3-6 flowered, pubescent, bracteate corymbs; calyx, obconic, pubescent; petals, broader than long; stamens, 10; styles, 3-5; fruit, globose, 9-14 mm. diameter; nutlets, 3-5.

†*C. rubella* Beadle. Branchlets numerous, armed with slender, straight, or slightly curved spines, 1.5-4 cm. long; leaves, oval or obovate, 3-9 cm. long, including the petiole; sharply and doubly serrate to near the base; prolonged into a margined, sparsely-glandular petiole; flowers in simple 3-6 flowered glandular bracteate corymbs; calyx, obconic; petals, rather broader than long, 8-12 mm. wide; stamens, normally 10; styles, 2-4, rarely 5; fruit, red, pyriform, or oval, 12-15 mm. long, ripening middle of September; nutlets, 2-3, rarely 4-5.

‡*C. sinistra* Beadle. Small tree; leaves, obovate, scarcely, if at all, glandular; stipules, linear, not exceeding 1 cm. in length; flowers, in 7-15 flowered corymbs; calyx, obconic, pilose; petals, nearly orbicular; the claw at the base, short; stamens, 10; styles, 1-2; fruit, oval, 6-8 mm. wide, reddish, ripening in November; nutlets, 1-2; flowers, May.

§*C. straminea* Beadle. Branchlets armed with slender spines; leaves, oval, round-ovate, acute at the apex, acutely contracted or rounded at the base, acutely incised or slightly 5-9 lobed, sharply and irregularly serrate except at the extreme base; serratures, glandular; apiculate, 2.5-10 cm. long, including the petiole, with 3-5 pairs of veins; flowers, in glandular-bracteate 3-6 flowered corymbs; calyx, obconic; petals, nearly orbicular, 6-10 mm. diameter; stamens, normally 10; fruit, subglobose or pyriform, 10-13 mm. high, yellow or greenish yellow, ripening middle of September; nutlets, 3-5.

\*\**C. tetrica* Beadle. A tree 5-7 m. tall, with short trunk; spines, very stout, 1-5.5 cm. long, curved or straight; stipules, linear, or on the longer shoot lineate; leaves, broadly oval, 3-7 cm. long, with petiole, rounded at the apex, sharply and irregularly serrate; corymbs, 10-20 flowered; calyx, obconic; petals, orbicular; stamens, 10; styles, 2; fruit, globose, 7 mm. by 1 cm. diameter.

††*C. Buckleyi* Beadle. Leaves, glabrous at maturity, ultimately subcoriaceous, ovate or round-ovate, and incisely lobed, acute at the apex, narrowed at the base, and prolonged into a margined petiole; flowers, in 3-7 flowered corymbs; calyx, obconic; petals, orbicular; stamens, 10; styles, 3-5; fruit, subglobose, angled, red, 8-12 mm. diameter, with 3-5 nutlets. (Biltmore Bot. Studies, Vol. I., No. 1.)

\**C. Margaretta* Ashe. Nashville, Charlotte Pike. April, May.

†*C. macrosperma* Ashe. Frequent on Lookout Mt.

‡*Gattingeri* Ashe. Nashville.

*C. collina* Chapm. Banks of Cumberland River, near waterworks.

*C. Vailliae* Britton. Wolf Creek, Cocke County. J. H. Kearney.

*C. populifolia* Elliott. Lebanon Pike, Nashville. Cowan.

### COTONEASTER Med.

*Cotoneaster Pyracantha* (L.) Spach. Evergreen thorn. Thickets near Hyde's Ferry, Nashville. Introduced. May.

### DRUPACEÆ DC.

#### PRUNUS L.

*Prunus Americana* Marsh. Wild yellow or red plum. O. S. April, May. Fruit ripe in July, August.

*P. hortulana* Bailey. Wild goose plum. O. S. Formerly believed to be a hybrid between *P. Americana* and *Chickasa*. April, May.

\**C. Margaretta* Ashe. Small tree, 4-5 m. high, sometimes a shrub; branches, flexuous geniculate, thornless, or only sparingly beset with short, slender thorns; leaves, glandless membranaceous, bright green both sides, broadly rhombic to broader than long, with 3-6 prominent, straight veins, obtusely serrate, with 3-5 pairs shallow lobes; flowers, in 7-12 flowered corymbs; petals, orbicular; stamens, 15-20; styles, 2-3; fruit, 1 cm. diameter, nearly round, reddish or orange.

†*C. macrosperma* Ashe. (Journal Elisha Mitchell Soc., December, 1900.) Small tree 5-7 m. in height, with wide-spreading branches, armed with numerous short, very stout, 1-2 cm. long, red brown to black thorns; leaves, membranaceous, but firm, dark green above, paler and sparingly glaucous or whitish beneath, deltoid or broadly oval at the apex, rounded or subcordate, with a narrow sinus at base, 3-6 cm. long, 2-5 wide, sharply serrate to the base; flowers, in 4-9 flowered simple corymbs on slender petioles; divisions of calyx, lanceolate, short, 3-5 mm. long, persistent and coloring with the fruit; styles, 3-4; stamens, 5-10; fruit, 12-18 mm. diameter; flesh, thick and mealy, falling in September; nutlets, 3-5.

‡*Gattingeri* Ashe. (Journal Elisha Mitchell Soc., December, 1900.) Twigs, glabrous, dark purple brown, sparingly glaucous, armed with numerous thorns, 3-4 cm. long; leaves, glabrous, dark green above, paler beneath, the blades oblong, ovate, or deltoid in outline, 2-7 cm. long, 2-5 cm. wide, rounded, truncate, or subcordate at base, attenuate at the apex, finely but acuminately serrate, generally with 3-5 prominent lobes; petioles, slender, roughened above, with 1-2 pairs of glands; corymbs, few-flowered, the pedicels slender and glabrous, 1-1.5 cm. long; calyx lobes, short, triangular, glabrous; stamens, 20; fruit, dark red, sparingly pruinose, globular, 8-11 mm. thick, generally capped by the stalked calyx lobes, persistent until after the foliage has fallen.

**P. angustifolia** Marsh. *P. Chickasa* Michx. Chickasa plum. Very frequent in the limestone basin of M. Tenn. April. Fruit ripe in May, June.

**P. gracilis** Engelm & Gray. In Tennessee, according to Gray's Manual.

**P. spinosa** L. Sloe blackthorn. Hillsboro Pike, twelve miles from Nashville. Escaped into the woods from an orchard. Adventitious from Europe. April.

**P. Cerasus** L. Sour cherry. In cultivation, and sometimes escaping into open grounds. Native of Europe. April, May. Fruit in June, July.

**P. avium** L. Sweet cherry. Also cultivated like the former in several varieties, and wandering into open grounds. Tennessee is at the Southern limit of the natural zone of both species; and, therefore, the fruit is inferior.

**P. domestica** L. Damson. Cultivated only.

**P. Pennsylvanica** L. fil. Pin or pigeon cherry. E. Tenn. Principally in the higher mountains. On Clingman Dome a form is found with narrow, lanceolate leaves. April-June. The latter is perhaps *P. serotina montana* Small.

**P. Armeniaca** Willd. Apricot. Native of Persia. In cultivation only.

**P. Virginiana** L. Chock cherry. Cumberland and Alleghany Mts. April, May.

**P. serotina** Ehrh. Wild black cherry. Large tree, often from 50 to 70 feet high. Wood used in cabinetmaking. May. Fruit ripe in August. *M.*

### AMYGDALUS L.

**Amygdalus Persica** L. Peach. Frequently escaped from cultivation. To be considered naturalized. April. Fruit in August-October.

**A. communis** L. Almond. Rarely found in cultivation.

### MIMOSACEÆ Reichenb.

#### ACACIA Adans.

**Acacia Julibrissin** L. Native of Persia. In gardens.

**A. lophantha** L. Appears here and there in gardens, and endures hard winters.

#### ACUAN Med. (*Desmanthus* Willd.)

**Acuan Illinoensis** (Michx.) Kuntze. *Desmanthus brachylobus* Benth. Frequent in the glades of M. Tenn. May-September.

**MORONGIA** Britton. (*Schrankia* Willd.)

*Morongia uncinata* (Willd.) Britton. *Schrankia uncinata* Willd. Sensitive brier. Dry soil. W. Tenn., Brownsville. May-July.

*M. angustata* (Torr. & Gray) Britton. *Schrankia angustata* P. & I. Dry soil. In the glades of M. Tenn., extending into the Alleghany and Cumberland Mts. May-July.

## CAESALPINACEÆ Kl. &amp; Garke.

**CERCIS** L.

*Cercis Canadensis* L. Red bud. In rich soil. O. S. March, April. *M.*

**CASSIA** L.

*Cassia nictitans* L. Sensitive pea. Siliceous soils. O. S. July-October.

*C. Chamæcrista* L. Partridge pea. Sunny hillsides in siliceous formations.

*C. Torra* L. *C. obtusifolia* L. Low senna. In damp, rich clay soils. River banks. O. S. July-October.

*C. Marylandica* L. Wild senna. Bottom lands and waste ground. O. S. July, August. *M.*

*C. occidentalis* L. Coffee senna. Jasper, E. Tenn. R. M. Middleton. June, July.

**GLEDITCHIA** L.

*Gleditchia triacanthos* L. Honey locust. Large tree, attaining 100 feet by 4 feet diameter. Limestone regions. O. S. May-July. *M.*

*G. aquatica* Marsh. *G. monosperma* Walt. Water locust. W. Tenn. July.

**GYMNOCLADUS** Lam.

*Gymnocladus dioica* (L.) Koch. *G. Canadensis* Lam. Large forest tree, attaining 100 feet high by 3 feet diameter. Scatteringly O. S. Kentucky coffee tree. May.

## PAPILIONACEÆ L.

**CLADRASTIS** Raf.

*Cladrastis lutea* (Michx.) Koch. *C. tinctoria* Raf. Yellow wood. Hills south of Nashville. E. Tenn. Attaining 50 feet high by 4 feet diameter. Trunk liable to early decay. June.

**BAPTISIA** Vent.

*Baptisia australis* (L.) R. Br. Blue false Indigo. Cedar glades at Lavergne. June-August.

- B. tinctoria** (L.) R. Br. Abundant in Cumberland and Alleghany Mts. June. *M.*  
**B. alba** (L.) R. Br. White wild Indigo. Mts. of E. Tenn. Ducktown. June.

### CROTALARIA L.

- Crotalaria sagittalis** L. Rattlebox. Dry, sandy soil. O. S. June, July.

### LUPINUS L.

- Lupinus perennis** L. Wild lupine. Woods near Hiwassee, Polk County. Also S. W. Va. J. K. Small. May, June.  
**L. albus** L. Field lupine. Sometimes found in gardens. Makes heavy crops in S. Europe.

### MEDICAGO L.

- Medicago sativa** L. Alfalfa Luzerne. Cultivated for forage. Introduced from Europe. Frequent in cultivated grounds. Summer.  
**M. lupulina** L. Black medic. Waste places. Capitol hill. Native from Europe. March-May.

### MELILOTUS Juss.

- Melilotus alba** Desv. White melilot. Bokhara clover. Waste places. O. S. Adventitious from Europe. Fragrant in drying and good for fodder. June-September.  
**M. officinalis** (L.) Lam. Yellow melilot. Introduced and spread like the former. Both species ought to be cultivated for forage. June-August.

### TRIFOLIUM L.

- Trifolium agrarium** L. Yellow or hop clover. Along roadsides and waste places, but only locally. Naturalized from Europe. May-September.  
**T. procumbens** L. Hop trefoil. Abundant in old fields and pastures. O. S. Naturalized from Europe. May-September.  
**T. dubium** Sibthorp. *T. procumbens* var. *minus* Koch. Occasional. O. S. Nashville. Naturalized from Europe. May-September.  
**T. incarnatum** L. Crimson clover. Cultivated for fodder. Introduced from Europe. Summer.  
**T. arvense** L. Rabbit foot. In sterile waste ground. Frequent. O. S. Naturalized from Europe. May-September.  
**T. pratense** L. Red clover. Best fodder plant. Native of

S. Europe and W. Asia. Fully naturalized, it sustains itself in fields and meadows. April-November.

**T. reflexum** L. Buffalo clover. Banks of Cumberland River, below Nashville. April-July.

**T. stoloniferum** Michx. Running Buffalo clover. Very common in rocky limestone glades in M. Tenn. May-August.

**T. hybridum** L. Alsike or Alsatian clover. Sometimes cultivated for fodder and spontaneous, but infrequent in pastures and meadows. Naturalized from Europe. O. S. May-October.

**T. repens** L. White clover. In fields and open places. O. S. May-December.

### PSORALEA L.

**Psoralea pedunculata** (Mill.) Vail. *P. melilotoides* Michx. Samson's snakeroot. Hills and highlands of M. Tenn.

**P. Onobrychis** Nutt. Sainfoin *Psoralea*. Banks of Tennessee and Cumberland Rivers. June, July.

**P. subacaulis** T. & G. Cedar glades and rocky lands of M. Tenn. Tuber highly farinaceous. March-June.

### AMORPHA L.

**Amorpha fruticosa** L. False Indigo. Along streams. O. S. May, June.

**A. canescens** Pursh. Lead plant. Grainger County. A. Ruth.

**A. Tennensiensis** Shuttlw. Alleghany Mts. Wolf Creek and Ocoee River, above Parksville. April-June.

**A. virgata** Britt. Mts. of E. Tenn. C. L. Boynton.

### PAROSELA Cav. (*Dalea* Willd.)

**Parosela Dalea** (L.) Britton. *Dalea alopecuroides* Willd. Frequent in W. Tenn. August, September.

### PETALOSTEMON Michx.

**Petalostemon candidus** (Willd.) Kuntze. *P. candidus* Michx. White prairie clover. Cowan, near tunnel. Paradise Ridge, Davidson County. July, August.

**P. purpureus** (Vent.) McM. *P. Violaceus* Michx. Cedar glades of M. Tenn. July, August.

**P. foliosus** (A. Gray) Kuntze. Frequent in vicinity of Nashville and the cedar glades. June, July.

\***P. Gattingeri** Heller. *Petalostemon decumbens* Nutt. Frequent in the cedar glades of M. Tenn. A white variety is found at Lavergne, Rutherford County. June, July.

### INDIGOFERA L.

**Indigofera tinctoria** L. Indigo. Formerly cultivated for home use by country people for dyeing homespun goods. E. Tenn. July, August.

### CRACCA L. (Thephrosia Pers.)

**Cracca Virginiana** L. *Thephrosia Virginiana* Pers. Catgut. Dry, siliceous soils. Common in the oak barrens. O. S. June, July.

**C. spicata** (Walt.) Kuntze. Same range with the former. O. S. June-August.

### KRAUNHIA Raf. (Wistaria Nutt.)

**Kraunhia frutescens** (L.) Greene. *Wistaria frutescens* Poir. Mts. at Cowan. May, June.

†**K. macrostachys** Small. Banks of Cumberland River, below Nashville. May.

### ROBINIA L.

**Robinia Pseudacacia** L. Yellow or black locust. Tree attaining a height of 80 feet. O. S. May, June.

**R. viscosa** Vent. Clammy locust. Grand View, E. Tenn. Miss Hattie R. Stratton. Knoxville. A. Ruth. June.

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\***P. Gattingeri** Heller n. sp. vide Bull. Torr. Bot. Club, Vol. XXIII., No. 4, p. 121; April 11, 1896. Perennial; stems, a foot in length or more, usually branching from the base, sometimes decumbent, sparingly glandular and pubescent, sometimes villous on the peduncles; leaflets, 2 or 3 pairs, narrowly linear or oblong, from  $\frac{1}{2}$  to  $\frac{3}{4}$  of an inch long, one line in width or less, dull and glandular on the upper side, light green beneath, the midvein prominent; spikes on rather short peduncles, cylindrical, loose, especially when old, from 1 to  $2\frac{1}{2}$  inches long; bracts, slightly longer than the calyx, oval-lanceolate, slender-pointed, glandular, pubescent; calyx, pubescent, with spreading hairs, the lanceolate lobes slightly shorter than the tube and more pubescent; petals, deep rose purple; ovary and base of style, pubescent.

†**K. macrostachys** Small. *Wistaria frutescens* var. *macrostachys* T. C. Gray. A vine sometimes from 20 to 25 feet long, stem becoming 2 inches thick, branching; leaves, 4-8 inches long; leaflets, usually 9, ovate to elliptic-lanceolate,  $1\frac{3}{4}$  inches long, acuminate or acute, rounded or cordate at the base; racemes, 8-12 inches long, loosely flowered, drooping; rachis and pedicels, densely hirsute and glandular; calyx, pubescent, like the pedicels; the tube, campanulate; the segments, lanceolate, lateral ones about as long as the tube, lower ones longer; corolla lilac, purple or light blue; standard, with blade 7 lines broad, decurrent on the claw; pods, 2-4 inches long, constricted between the black, lustrous seeds. (Illustrated Flora; Appendix, page 517.)

*R. hispida* L. Rose Acacia. Lookout Mt., Chattanooga. Young plants bear flowers when only a span high. Var. *nana* Ell. Very ornamental in cultivation. May.

### ASTRAGALUS L.

*Astragalus crassicaarpus* Nutt. *A. caryocarpus* Ker. Ground plum. Cedar glades near Lavergne Station.

*A. Tennesiensis* A. Gray. Milk vetch. Very frequent in the rocky glades of M. Tenn. March-May.

*A. Carolinianus* L. *A. Canadensis* L. O. S. July, August.

### STYLOSANTHES Sw.

*Stylosanthes biflora* (L.) B. S. P. *St. elatior* Sw. Pencil flower. Siliceous soils. O. S. June-September.

*S. riparia* T. H. Kearney. At Sewanee both species occur in close proximity. O. S. June-September.

### MEIBOMIA Adans. (Desmodium Desv.)

*Meibomia nudiflora* (L.) Kuntze. *Desmodium nudiflorum* DC. Woods. O. S. July, August.

*M. grandiflora* (Walt.) Kuntze. *Desmodium acuminatum* DC. Dry, rocky woods. O. S. June-September.

*M. pauciflora* (Nutt.) Kuntze. *Desmodium pauciflorum* DC. In leaf mold. O. S. July.

*M. Michauxii* Vail. *Desmodium rotundifolium* DC. Woods. O. S. July-September.

*M. ochroleuca* (M. A. Curtis) Kuntze. *Desmodium ochroleucum* M. A. Curtis. Knoxville. A. Ruth.

*M. glabella* (Michx.) Kuntze. *Desmodium humifusum* Beck. Highlands of M. Tenn. Ridge Top, Baker's Station.

*M. sessilifolia* (Torr.) Kuntze. *Desmodium sessilifolium* T. & G. Along railroad, Mitchellville, Sumner County. July-September.

*M. canescens* (L.) Kuntze. *Desmodium canescens* DC. Highlands of M. Tenn. July-September.

*M. bracteosa* (Michx.) Kuntze. *Desmodium cuspidatum* Hook. Ridge Top, Sumner County. In siliceous soil. July, August.

*M. paniculata* (L.) Kuntze. *Desmodium paniculatum* DC. The most common species in calcareous and siliceous soils. July-September.

*M. lævigata* (Nutt.) Kuntze. *Desmodium lævigatum* DC. O. S.

*M. viridiflora* (L.) Kuntze. *Desmodium viridiflorum* Beck. Siliceous soils. O. S. August-October.

**M. Dillenii** (Darl.) Kuntze. *Desmodium Dillenii* Darl. O. S. July.

**M. Canadensis** (L.) Kuntze. *Desmodium Canadense* DC. Cumberland Mts., Cowan. July-September.

**M. rigida** (Ell.) Kuntze. *Desmodium rigidum* DC. Cedar glades. Lavergne. July-October.

**M. Marylandica** (L.) Kuntze. *Desmodium Marylandicum* Boott. Cedar and oak barrens. M. Tenn. July-September.

**M. obtusa** (Mühl.) Vahl. *Desmodium ciliare* DC. Barrens. July-October.

### LESPEDEZA Michx.

**Lespedeza repens** (L.) Bart. Creeping bush clover. Siliceous soils. O. S. August, September.

**L. procumbens** Michx. *L. repens* var. *procumbens*. Gray's Man. O. S. August, September.

**L. violacea** (L.) Pers. Dry copses. O. S. August, September.

**L. Stuvei** Nutt. Highlands of M. Tenn. August. Var. *intermedia* S. Watson. With preceding.

**L. frutescens** (L.) Britton. *L. reticulata* S. Watson. Harpeth hills. August, September.

**L. hirta** (L.) Ell. *L. polystachya* Michx. Dry, siliceous soils. O. S. August-October.

**L. capitata** Michx. Harpeth hills. Tullahoma.

**L. leptostachya** Engelm. Dry hill lands. W. Tenn. August, September.

**L. striata** (Thunb.) H. & A. Japan clover. Widely spread over the whole State, carpeting the ground with a beautiful sod. Has been in the remotest mountain settlements since fifty years, and is probably indigenous. Also found in Japan, from whence it is believed to have been imported. July, August. It is an annual.

### VICIA L.

**Vicia Americana** Mühl. Thickets, vicinity of Nashville. May-July.

**V. Caroliniana** Walt. Valleys of E. Tenn. May-July.

**V. micrantha** Nutt. Copses and edge of woods. M. Tenn. Nashville. April, May.

**V. sativa** L. Common vetch or tare. Sometimes sown with rye and cut for fodder. Native of Europe. May-August.

**V. Faba** L. Common field pea. Small patches are occasionally found in gardens.

**ERVUM L.**

**Ervum Lens L.** The lentil is sparingly cultivated for culinary use. May-July.

**PISUM L.**

**Pisum sativum L.** Garden pea. Cultivated as field and garden crops in many varieties. **Pisum arvense L.** preferred for field culture.

**CICER L.**

**Cicer arietinum L.** Sugar pea. Already known to the lake dwellers. Cultivated by all truck farmers.

**LATHYRUS L.**

**Lathyrus venosus** Mühl. Mts. of E. Tenn. A. Ruth. Kate's Mt., S. W. Va. J. K. Small. May-July.

**L. myrtifolius** Mühl. **L. palustris** var. **myrtifolius** A. Gray. According to Illustrated Flora, in E. Tenn. May-July.

**BRADBURYA Raf. (Centrosema Benth.)**

**Bradburya Virginiana (L.) Kuntze.** Spurred butterfly. **Centrosema Virginianum Benth.** Siliceous soils. O. S. Piney Creek, Rhea County. Mrs. L. Bennett. July, August.

**CLITORIA L.**

**Clitoria Mariana L.** Dry, sunny places in siliceous ground. O. S. June, July.

**FALCATA Gmel. (Amphicarpaea Ell.)**

**Falcata comosa (L.) Kuntze.** **Amphicarpaea monoica Ell.** Hog peanut. Damp woodlands. O. S. August, September.

**F. Pitcheri (T. & G.) Kuntze.** **Amphicarpaea Pitcheri T. & G.** Fide Illustrated Flora.

**APIOS Mönch.**

**Apios Apios (L.) McM.** **Apios tuberosa Mönch.** Groundnut. Moist thickets. O. S. Climbing or trailing over shrubs. O. S. July-September.

\***A. Priceana** B. L. Robinson. Similar localities with the former. Nashville. May, June.

### GALACTIA P. Br.

**Galactia regularis** (L.) B. S. P. *G. glabella* Michx. Milk pea. Open grounds. O. S. July, August.

**G. volubilis** (L.) Britton. *G. pilosa* Ell. *G. mollis* Nutt. White Bluff, Dickson County. June, July.

**G. mollis** Michx. *G. pilosa* Nutt. Common in open, dry ground. O. S. July, August.

### RHYNCHOSIA Laur.

**Rhynchosia tomentosa** (L.) H. & A. Dry, siliceous soil. O. S. May-July.

### PHASEOLUS L.

**Phaseolus polystachys** (L.) B. S. P. *P. perennis* Walt. Wild bean. Brownsville Cumberland Mts. Mrs. Lydia Bennett. July-September.

**P. vulgaris** Savi. Common harricot. Pole bean. Var. *nanus* bush bean. Cultivated since the dawn of culture to the present day in many varieties. Believed to have come from W. Asia.

**P. lunatus** L. The lima bean is claimed for the intertropical

\***A. Priceana** B. L. Robinson. (Torr. Bot. Bull. 1898.) Vigorous herbaceous twiner; stem, terate, slightly striate, at first covered with a fine reflexed pubescence, but soon nearly glabrate, arising from a large oblate spheroidal root (18 cm. diameter); leaves, 3-9 foliate, those of the main stem 24 cm. long, the ovate or ovate-lanceolate acuminate leaflets sparingly pubescent upon both surfaces, green and scarcely paler beneath, thin and rather veiny, obtuse or rounded at the base, 4-10 cm. long, half as broad; petiolules, hirsutulous; leaves and leaflets of the branches, considerably smaller; stipules, subulate, pubescent, 6 mm. long; racemes, dense, borne mostly by twos and threes in the axils, those of the main stem often 12-15 cm. long, 50-70 flowered, and mostly bearing a single short branch; rameal inflorescences, smaller and simple; floral axes, thickish; pedicels, slender, 5 mm. long, commonly borne by twos and threes in the axils of ovate caudate-acuminate bracts at somewhat greater length; calyx, hemispherical roseate; the limb, obliquely subtruncate, except for the linear-attenuate anterior tooth; petals, greenish white, tinged especially toward the end with rose purple or magenta; the vexillum suborbicular 25 mm. long, biauriculate at the base and bluntly cornute at the apex; wings, somewhat shorter, narrowly oblong, a little broadened and rounded at the apex; essential organs of the genus; pods, clustered, 12-15 cm. long, 1 cm. broad, acuminate at the apex, attenuate at the base, about 10 seeded; seeds, oblong, olive green, 8 mm. long, separated in the pod by biconcave sections of the silvery-white pithy endocarp. First collected and distinguished by Miss Sady F. Price, of Bowling Green, Ky.

parts of both hemispheres, and cultivated with us as a runner and a bush bean.

**P. multiflorus** L. The scarlet runner. It succeeds only on the higher mountains, but sets no pods in the lowlands of this State.

### ARACHIS Willd.

**Arachis hypogæa** Willd. Peanut. Goober pea. Native of tropical S. America. Largely cultivated in the western part of the State for its seeds and the oil which is obtained from them. August-October. *M.*

### STROPHOSTYLES Ell. (Phaseolus L.)

**Strophostyles Helvola** (L.) Britton. Phaseolus Helvolus L. Strophostyles angulosa Ell. Sandy soil. O. S. July-October.

**S. umbellata** (Mühl.) Britton. Ph. Helvolus T. & G. P. peduncularis Ell. Abundant in the barrens. July-September.

**S. pauciflora** (Benth.) S. Watson. In rich, moist grounds. O. S. July-September.

### VIGNA Savi.

\***Vigna Sinensis** (L.) Endl. and var. *V. melanocarpa*. Cow pea. Planted between corn rows. In cultivation only. O. S. July-September.

### GERANIACEÆ J. St. Hilaire.

#### GERANIUM L.

**Geranium maculatum** L. Spotted crane's bill. Woods. O. S. April-July. *M.*

**G. Carolinianum** L. Carolina crane's bill. Waste grounds. O. S. April-August.

**G. pusillum** L. Slopes of White Rock Mts., S. W. Va. Adventive from Europe. May.

### OXALIDACEÆ Lindl.

#### OXALIS L.

**Oxalis Acetosella** L. White wood sorrel. Summits of the high mountains of E. Tenn. May-July.

**O. violacea** L. Rocky woods. O. S. May, June.

**O. macrantha** Trelease. Rocky glades. M. Tenn. April-September.

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\*Two allied species have been recently introduced from the tropics, the soja bean (*Glycine hispida*) and the velvet bean (*Mucuna utilis* Wall.). It has been found that the seasons of Tennessee are not always long enough to perfect their growth.

*O. filipes* Small n. sp. In Tennessee. Fide Illustrated Flora. May-August.

*O. stricta* L. Woods. O. S. April-October.

*O. grandis* Small. *O. recurva* Trelease. Rich soils. O. S. May-August.

*O. corniculata* L. In fields and gardens. Introduced. February-November.

*O. hirsuticaulis* J. K. Small. Nashville. Open woods. With *O. macrantha*. April, May.

#### LINACEÆ Dumort.

##### LINUM L.

*Linum usitatissimum* L. Flax. Linseed. Along roadsides. Adventitious from Europe or fugitive from cultivation, which has recently greatly declined in this State. Summer. *M.*

*L. Virginianum* L. Yellow flax. Dry, open woodlands. O. S. June-August.

*L. Floridanum* (Planch.) Trelease. Near Dickson, Dickson County.

*L. striatum* Walt. Cedar and oak barrens. O. S. June.

*L. sulcatum* Riddel. Hickman, W. Tenn. Summer.

#### RUTACEÆ Juss.

##### XANTHOXYLUM L.

*Xanthoxylum Americanum* Mill. Prickly ash. Hills vicinity of Nashville. April, May. *M.*

##### PTELEA L.

*Ptelea trifoliata* L. Three-leaved hop tree. Common shrub in the limestone regions of Tennessee. June. *M.*

##### RUTA L.

*Ruta graveolens* L. Common garden rue. Found in an open field at Belvidere, Franklin County. Introduced. June. *M.*

#### SIMARUBACEÆ DC.

##### AILANTHUS Desf.

*Ailanthus glandulosa* Desv. Tree of heaven. Ailanthus. Fully naturalized, and spreading. The male tree is objectionable for planting in streets on account of the disagreeable odor of its flower. Native of China. June-September. *M.*

## MELIACEÆ DC.

**MELIA L.**

*Melia Azedarach* L. Formerly frequently seen in yards, but apparently dying out. Pride of India China tree.

**KÆHLREUTERA DC.**

*Kœhlreutera paniculata* DC. Recently introduced, but seemingly not bearing rigorous winters.

## POLYGALACEÆ.

**POLYGALA L.**

*Polygala cruciata* L. Marsh milkwort. Oak barrens. O. S. July.

*P. verticillata* L. Mts. of E. Tenn. Tuckalechee Cove June.

*P. ambigua* Nutt. Dry soils. O. S. Nashville. May-July.

*P. incarnata* L. Barrens, siliceous and rather moist soils. Summer.

*P. viridescens* L. *P. sanguinea* L. Cumberland Mts. J. F. James.

*P. Curtissii* A. Gray. Barrens and mountains of E. Tenn. August, September.

*P. Mariana* Mill. *P. fastigiata* Nutt. Sewanee. July, August.

*P. Nuttallii* T. & G. *P. sanguinea* Nutt. Siliceous soils. O. S. July, August.

*P. Senega* L. Seneca snakeroot. O. S. May, June.

*P. Senega latifolia* T. & G. E. Tenn. and vicinity of Nashville. May, June.

*P. polygama* Walt. Valley of E. Tenn. Frequent. June, July.

*P. paucifolia* Willd. Flowering wintergreen. Cumberland Mts. Rugby. Mrs. Percival. Alleghany Mts.

## EUPHORBIACEÆ J. St. Hil.

**PHYLLANTHUS L.**

*Phyllanthus Carolinensis* Walt. Pastures and glades. O. S. May-October.

**CROTON L.**

*Croton glandulosus* L. O. S. Not as common as the following. July-September.

*C. capitatus* Michx. Dry soils, especially M. Tenn. June-September.

*C. monanthogynus* Michx. Dry pastures. O. S. June-October. *M.*

### CROTONOPSIS Michx.

*Crotonopsis linearis* Michx. Cedar barrens. Summit of Lookout Mt. July-September.

### ACALYPHA L.

*Acalypha ostryæfolia* Ridd. A. Caroliniana Ell. Gardens and fields. O. S. June.

*A. Virginica* L. Fields and thickets. O. S. June-October.

*A. gracilens* A. Gray. Dry, rocky grounds. O. S. June-September.

### TRAGIA L.

*Tragia nepetæfolia* Cav. East of Cleveland, Bradley County. May-October.

*T. macrocarpa* Willd. Severely stinging. Abundant in the cedar barrens of M. Tenn. Nashville. June-September.

### RICINUS L.

*Ricinus communis* L. Castor-oil plant. Cultivated as an ornamental plant, and escaping into waste places. July-September. *M.*

### STILLINGIA L.

*Stillingia sylvatica* L. Queen root. Vicinity of Memphis. Dr. G. Egeling. March-October. *M.*

### EUPHORBIA L.

*Euphorbia serpens* H. B. K. Abundant in glades and cultivated grounds. Nashville. July-September.

*E. maculata* L. Spotted spurge. O. S. June-November.

*E. humistrata* Engelm. River banks and moist grounds. Nashville. July, August.

*E. nutans* Lag. *E. hypericifolia* A. Gray. A troublesome weed in cornfields. O. S. May-October. *M.*

*E. corollata* L. Flowering spurge. Open woodlands. O. S. April-October. *M.*

*E. marginata* Pursh. Along lines of railroads. An immigrant from the West. May-October.

*E. dentata* Michx. Glades of M. Tenn. Nashville. June-September.

*E. Ipecacuanhæ* L. W. Tenn. May.

*E. heterophylla* L. Harpeth hills, near Nashville. April-November.

*E. Lathyris* L. Vicinity of Roane Mt. J. W. Chickering. May, June.

*E. obtusata* Pursh. Frequent in glades around Nashville. March-June.

*E. commutata* Engelm. Cedar barrens of M. Tenn. April.

*E. mercurialina* Michx. Stoner's Creek, Wilson County. Tunnel Hill, Sumner County. Lookout Mt. May-July.

### CALLITRICHACEÆ Lindl.

#### CALLITRICHE L.

*Callitriche Austini* Engelm. Water starwort. On mud banks along streams. Nashville. July.

*C. heterophylla* Pursh. Ponds near Nashville. July-September.

### BUXACEÆ Dumirt.

#### PACHYSANDRA Michx.

*Pachysandra procumbens* Michx. Dr. Hampton's farm, Davidson County. White Bluff, Dickson County. Beersheba Springs, Grundy County. Col. Wilkins. April, May.

### ANACARDIACEÆ Lindl.

#### RHUS L.

*Rhus copallina* L. Darf. sumac. Poor, siliceous soils. O. S. June-August.

*R. hirta* (L.) Ludw. *R. tyhina* L. Staghorn sumac. Hill-sides. O. S. June.

*R. glabra* L. Scarlet sumac. Old fields. O. S. June-August. *M.*

*R. aromatica* Ait. *R. Canadensis* Marsh. Limestone regions of M. Tenn. March, April. *M.*

*R. trilobata* Nutt. *Rh. aromatica* var. *trilobata* Gray. Occurs over the same range. *M.*

*R. Vernix* L. *R. venenata* DC. Poison sumac. Poison ash. Boggy lands in the Cumberland Mts. Sewanee. June. *M.*

*R. radicans* L. *R. Toxicodendron* Michx. Poison oak. E. Tenn. May, June. *M.*

*R. Toxicodendron* L. With crenately-lobed, very-pubescent leaves. Nashville. *M.*

#### COTINUS Adans.

*Cotinus cotinoides* (Nutt.) Britton. *R. cotinoides* Nutt. Southern border of the State. Limestone County, Ala. Dr. Charles Mohr. April, May.

## ILICINÆE Lowe.

## ILEX L.

*Ilex opaca* Ait. American holly. A slim tree in the Cumberland and Alleghany Mts.. Attains a height of 50 feet by 18 to 20 inches diameter in the Cumberland and Hiwassee River bottoms. April. Fruit matures in November, December. *M.*

*I. decidua* Walt. Swamp holly. Brownsville, W. Tenn. May.

*I. monticola* A. Gray. *I. montana* T. & G. Mts. of E. Tenn.

*I. monticola mollis* A. Gray. Lookout Mt. June, July.

*I. verticillata* (.L.) A. Gray. Black alder. Swamps at Hollow Rock, W. Tenn. E. Tenn. A. Ruth.

*I. ambigua* Chapm. Foot of mountains near tunnel at Cowan. July, August.

*I. Bidleyi* W. W. Ashe from the mountains of E. Tenn. Is perhaps identical with the foregoing.

## CELASTRACEÆ Lindl.

## EVONYMUS L.

*Evonymus Americanus* L. Strawberry bush. O. S. June. *M.*

*E. atropurpureus* Jacq. Burning bush. Wahoo. Along streams. O. S. June. *M.*

## CELASTRUS L.

*Celastrus scandens* L. Climbing bittersweet. Brownsville, W. Tenn. Also Bushy Mts., S. W. Va. J. K. Small. *M.*

## STAPHYLEACEÆ DC.

## STAPHYLEA L.

*Staphylea trifolia* L. American bladdernut. Moist woods. O. S. Nashville. April, May.

## ACERACEÆ St. Hil.

## ACER L.

*Acer saccharinum* L. *A. dasycarpum* Ehrh. Silver maple. A large tree reaching 100 feet by 3 feet diameter. Bottom lands and river banks. Flowers in February, March, and matures its seeds the earliest of all our plants.

*A. rubrum* L. Red or swamp maple. Wet or swampy lands. O. S. March, April.

*A. saccharum* Marsh. *A. saccharinum* Wanger. *A. bar-*

batum Michx. Sugar maple. Large tree. O. S. Frequent around Nashville. April, May.

*A. nigrum* Michx. *A. saccharinum* var. *nigrum* T. & G. Black sugar maple. Large tree. O. S. April, May.

*A. leucoderme* J. K. Small. Banks of Ocoee River above Parksville. C. L. Boynton.

*A. Pennsylvanicum* L. Moose wood. Striped maple. Smoky Mts. Slopes of White Top Mt., S. W. Va. J. K. Small.

*A. spicatum* Lam. Mountain maple. Small tree. Summit of Thunderhead. May, June.

*A. Negundo* L. *Negundo aceroides* Mœnch. Box elder. Large, irregularly-branching tree, growing alongside water courses. O. S. April.

#### HIPPOCASTANACEÆ T. & G.

##### ÆSCULUS L.

*Æsculus Hippocastanum* L. A large tree. Native of Asia. Frequently planted in cities, but not enduring high temperatures. Horse chestnut. May.

*Æ. glabra* Willd. Ohio buckeye. Frequent in the barrens of M. Tenn. April, May.

*Æ. octandra* Marsh. *Æ. flava* Ait. Yellow buckeye. O. S. April, May.

*Æ. octandra hybrida* Sargt. *Æ. flava* var. *purpurascens* A. Gray. A decumbent shrub. Frequent at the foot of the Cumberland Mts. and ravines in E. Tenn. Ought to be ranked as a species. April, May.

*Æ. Pavia* L. Red buckeye. Prospect Station, Giles County. A small tree. It is also flowering when only a span high, April, May.

*Æ. parviflora* Walt. A shrub. Very ornamental and planted in gardens. Native of N. Alabama, and perhaps also occurring on the southern borders of this State. April, May.

#### SAPINDACEÆ R. Br.

##### CARDIOSPERMUM L.

*Cardiospermum Halicacabum* L. Balloon vine. Native of tropical America. Frequently in cultivation and escaped. May-July.

#### BALSAMINACEÆ Lindl.

##### IMPATIENS L.

*Impatiens biflora* Walt. *I. fulva* Nutt. Spotted touch-me-not. Moist grounds. O. S. July-October.

*I. aurea* Mühl. *I. pallida* Nutt. Pale touch-me-not. Similar localities. O. S. July-September. *M.*

## RHAMNACEÆ Dumort.

## BERCHEMIA Neck.

*Berchemia scandens* (Hill.) Trel. *B. volubilis* DC. Supple jack. Lookout Mt. Very luxuriantly in low grounds in Brownsville, W. Tenn. March-June.

## RHAMNUS L.

*Rhamnus lanceolata* Pursh. Buckthorn. River banks and copses. Nashville. May. *M.*

*Rh. Caroliniana* Walt. Carolina buckthorn. Low grounds. O. S. May, June. *M.*

## ZIZYPHUS Lam.

*Zizyphus vulgaris* Lam. Jujuba. Cultivated in a few gardens. Fosterville. Small tree. Perfectly hardy. Abundant bearer. The fruit, a small plum of agreeable flavor, is commonly eaten in both fresh and dry state. Ought to be more largely cultivated. May.

## CEANOTHUS L.

*Ceanothus Americanus* L. New Jersey tea. Red root. In siliceous soils. O. S. May, June.

## VITACEÆ Lindl.

## VITIS L.

*Vitis Labrusca* L. Northern fox grape. Along the Alleghany Mts. Cultivated in Bayer's settlement, in the Frog Mts., as early as 1848 by French and German immigrants, and improved in size and flavor. It made very good wine. May. Fruit ripens in August, September.

*V. æstivalis* Michx. Summer grape. Uplands, cedar glades, and mountains. May. Fruit ripe in September, October.

*V. cinerea* Engelm. Downy grape. Along banks of Cumberland River, Nashville, and over M. Tenn. May. Fruit ripe in September.

*V. cordifolia* Michx. Frost grape. O. S. May. Fruit ripe in October, November.

*V. rupestris* Scheele. Sand grape. Islands of Cumberland River. Bluffs on Mill Creek and Stoner's Creek. Fruit ripe in July, August.

*V. rotundifolia* Michx. *V. vulpina* T. & G. Southern fox grape. Muscadine grape. In siliceous soil. Cumberland Mts. May. Fruit ripe in August, September.

*V. palmata* Vahl. River banks of Tennessee River. Fruit maturing in September.

**AMPELOPSIS** Michx.

*Ampelopsis cordata* Michx. *Vitis indivisa* Willd. River banks and moist woodlands, M. Tenn. Nashville. May, June.

*A. arborea* (L.) Rusby. *Vitis bipinnata* T. & G. Damp soil. W. Tenn. June, July.

**PARTHENOCISSUS** Planchon. (*Ampelopsis* Michx.)

*Parthenocissus quinquefolia* (L.) Planch. *Ampelopsis quinquefolia* Michx. Virginia creeper. O. S. June-August. *M.*

*P. tricuspidata* (Sieb. & Zucc.) Planch. *Ampelopsis Veitchii*. Frequently cultivated. Closely clinging to walls. Is a Japanese vine.

**TILIACEÆ** Juss.**TILIA** L.

*Tilia Americana* L. Basswood. Mts. of E. Tenn. May, June. *M.*

*T. heterophylla* Vent. White basswood. River banks and bottom lands. Nashville. June, July.

*T. Europaea* L. The European linden. Frequently planted as an ornamental tree. The exquisite fragrantcy of the flowers and its freedom from disease and insect pests recommend it for more frequent planting. May. *M.*

**MALVACEÆ** Neck.**MALVA** L.

*Malva sylvestris* L. Mallow. Waters of Holston River, S. W. Va. J. K. Small.

*M. rotundifolia* L. Cheeses. Naturalized from Europe. Waste places. O. S. Summer.

*M. verticillata* L. *M. crispa* L. Waste grounds. Adventitious. O. S. Summer.

*M. moshata* L. Musk mallow. S. W. Va. J. K. Small. Adventitious.

**CALLIRRHÖE** Nutt.

*Callirrhœ alcæoides* (Michx.) A. Gray. Copses along Brown's Creek, Nashville. In a glade near Edgefield Junction, Davidson County. T. S. Imboden.

**MALVASTRUM** A. Gray.

*Malvastrum angustum* A. Gray. Glades of M. Tenn. Very frequent around Nashville. July, August.

**SIDA L.**

**Sida spinosa** L. A bad weed, covering acres. O. S. Summer.

**S. Elliottii** T. & G. Frequent in the cedar glades. July, August.

**S. hermaphrodita** (L.) Rusby. In a fence row near Knoxville. June-August.

**ABUTILON** Gærtn.

**Abutilon Abutilon** (L.) Rusby. Indian mallow. **Abutilon Avicennæ** Gærtn. Adventive from S. Asia. O. S. August-October.

**HIBISCUS L.**

**Hibiscus Moscheutos** L. Swamp rose mallow. River banks and swamps. O. S. July, August.

**H. lasiocarpus** Cav. Swamps, Hickman County. August.

**H. militaris** Cav. **H. Virginicus** Walt. Along water courses. O. S. A white-flowered variety near Nashville. June, July.

**H. Trionum** L. Flower-of-an-hour. Adventive from S. Europe. July-September.

**H. Syriacus** L. Shrubby althæa. Rose of Sharon. Introduced from W. Asia. Sometimes escaped from cultivation. O. S. July-September.

**H. esculentus** L. Okra. Two varieties are in cultivation in gardens. June, July.

**GOSSYPIUM L.**

**Gossypium Barbādense** L. The cotton plant. The short staple or upland cotton is largely cultivated in the State. *M.*

## THEACEÆ DC.

**STUARTIA L.**

**Stuartia Malachodendron** L. **Stuartia Virginica** Cav. White Cliff Springs. Coal Creek. A. Ruth.

**S. pentagyna** L'Her. Cumberland and Alleghany Mts. June.

## HYPERICACEÆ Lindl.

**ASCYRUM L.**

**Ascyrum stans** Michx. St. Peter's wort. Moist thickets in the mountains. Siliceous soil. July, August.

**A. hypericoides** L. A. Crux-Andræ L. St. Andrew's Cross. Dry, siliceous soil. O. S. June-August.

## HYPERICUM L.

*Hypericum Kalmianum* L. St. John's wort. Typical low form. Cumberland Mts. Mrs. Lydia Bennett.

*H. Kalmianum* Majus. Stout shrubs, 5 to 7 feet high. Oak barrens at Tullahoma, Coffee County. July.

*H. prolificum* L. Cleveland, E. Tenn. Craggie Hope, Cheatham County. July-September.

*H. densiflorum* Pursh. Post Oak Springs, Roane County. Hiwassee Valley. A. Ruth. July-September.

*H. galioides* L. Along water courses in siliceous ground. Frequent in E. Tenn. June, July.

*H. adpressum* Bart. Wild-goose pond near Mitchellville, Sumner County. July-September.

*H. sphærocarpum* Michx. Frequent in the barrens of M. Tenn. Also in E. Tenn. July-September.

*H. dolabriforme* Vent. Chilhowee Mt., Parksville. Dry, gravelly hills, east of Cleveland, E. Tenn. July, August.

*H. virgatum* Lam. *H. angulosum* Michx. Damp places in the oak barrens at Tullahoma. Var. *acutifolium* Coult. With the former.

*H. perforatum* L. Common St. John's wort. Waste places. Uncommon. Introduced. June.

*H. maculatum* Walt. *H. corymbosum* Michx. An abundant weed in fields. O. S. July-September.

*H. graveolens* Buckl. Summit of Thunderhead. White Top Mt., S. W. Va. J. K. Small. June, July.

*H. mutilum* L. Edge of pools. O. S. June, July.

*H. gymnanthum* Engelm. & Gray. Barrens of M. Tenn. July.

*H. Canadense* L. Cumberland Mts. July-September.

*H. Drummondii* T. & G. Belvedere, Franklin County. July-September.

\**H. lobocarpum* Gattinger. Hollow Rock, W. Tenn. July, August.

*H. glomeratum* J. K. Small. I suppose to be the same as

\**H. lobocarpum* Gattinger. n. sp. Sepals, linear-lanceolate, small, unequal, 1½-3 lines long; petals, unequal, unsymmetric, 3-6 lines long, reflected, early deciduous; capsule, five-celled, deeply five-lobed, lanceolate, tapering into a long beak; carpels, almost distinct, and at full maturity falling away from a central axis; seeds, 1 mm. long, incurved, apiculate, striate lengthwise, transversely grooved; leaves, linear, obtuse, slightly mucronate, attenuate downward, pale underneath. Shrub 5-7 feet high, with upright branches. Low, swampy lands in the Orange Sand formation at Hollow Rock, Carroll County, W. Tenn. First collected in fruit in 1867, and again in July, 1886, in flower, in very swampy ground. I have since received specimens of a *Hypericum* labeled *H. prolificum*, "collected by D. H. E. Hasse, of Little Rock, Ark., in wet pine barrens," which proved to be the same species. M.

I enumerated in the first edition as *H. prolificum* var. *montanum*, collected in the Frog Mts. about 1870.

### SAROTHRA L.

*Sarothra gentianoides* L. *Hypericum nudicaule* Walt. Pine weed. Orange grass. In sandy soil. O. S. July, August.

### TRIADENUM Raf.

*Triadenum Virginicum* (L.) Raf. *Elodea Virginica* Nutt. River swamps. Scattering O. S. July-September.

*T. petiolatum* (Walt.) Britton. Cypress swamps. July, August.

### CISTACEÆ Lindl.

#### HELIANTHEMUM Pers.

*Helianthemum Canadense* (L.) Michx. Frost weed. Common in dry, siliceous soil. E. Tenn. April, May. *M.*

### LECHEA L.

*Lechea villosa* Ell. *L. Major* Michx. Dry, open grounds. O. S. July, August.

*L. minor* L. *L. thymifolia* Michx. Pinweed. Barrens of M. Tenn. and mountains of E. Tenn. July, August.

*L. racemulosa* Michx. Wolf Creek, Cocke County. T. H. Kearney. Waters of Holston River. J. K. Small.

*L. tenuifolia* Michx. Cumberland Mts., M. Tenn. June-August.

### VIOLACEÆ L.

#### VIOLA.

*Viola palmata* L. Early blue violet. *V. cucullata* var. *palmata* A. Gray. O. S. April.

*V. pedatifida* Don. *V. delphinifolia* Nutt. Prairie violet. Sewanee. Gen. E. Kirby-Smith. March-May.

*V. obliqua* Hill. *V. cucullata* Ait. O. S. April-June.

\**V. domestica* Bicknell. Yard violet. Nashville.

*V. villosa* Walt. Pond Mt., S. W. Va. J. K. Small. Knoxville. A. Ruth.

*V. sagittata* Ait. Highlands of M. Tenn. and mountains of E. Tenn. April, May.

*V. ovata* Nutt. *V. sagittata* var. *ovata* T. & G. Summit of White Top Mts., S. W. Va. J. K. Small.

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\**V. domestica* Bicknell. Yard violet. Nashville, in cultivated grounds. Resembles closely *V. obliqua*, but differs in the short-peduncled subterranean peduncles and broadly-reniform blades.

**V. pedata** L. Bird's-foot violet, and var. *bicolor* Pursh. Siliceous soils. Highlands. Harpeth hills, near Nashville. April. *M.*

**V. odorata** L. Sweet violet. Native of Europe. Frequently escaping from cultivation. March-May.

**V. rotundifolia** Michx. Cumberland Mts. March-May.

**V. blanda** Willd. Dry, rocky grounds. Hills around Nashville. April, May.

**V. blanda amœna** Le Conte. *V. blanda* var. *palustriformis* A. Gray. Iron Mts., S. W. Va. J. K. Small.

**V. renifolia** A. Gray. *V. blanda renifolia* A. Gray. Summit of Thunderhead. Smoky Mts. April-June.

**V. primulæfolia** L. Sewanee. E. Kirby-Smith. Grandview. Mrs. H. R. Stratton. May.

**V. emarginata** (Nutt.) Le Conte. Wolf Creek. T. H. Kearney.

**V. lanceolata** L. Cumberland and Alleghany Mts. Knoxville. March-May.

**V. hastata** Michx. Mts. of E. Tenn.

**V. hastata** var. *tripartita* Gray. Sewanee. E. Kirby-Smith. May.

**V. pubescens** Ait. Woods. O. S. Nashville. Var. *Criocarpa* Nutt. Highlands of M. Tenn. March-May.

**V. Canadensis** L. Cumberland and Alleghany Mts. May-July.

**V. striata** Ait. Nashville. O. S. April, May.

**V. multicaulis** (T. & G.) Britton. *V. Mühlenbergii* var. *multicaulis* T. & G. Mts. of E. Tenn. March-June.

**V. rostrata** Pursh. Sewanee. E. Kirby-Smith. Hiwassee Valley. A. Ruth.

**V. tenella** Mühl. *V. tricolor* var. *arvensis* Hook. Field pansy. Dry pastures. O. S. March-May.

### CUBELIUM Raf. (Solea Spreng.)

**Cubelium concolor** (Forst.) Raf. *Solea concolor* Ging. Damp woods. O. S. April, May.

### PASSIFLORACEÆ Dumort.

#### PASSIFLORA L.

**Passiflora incarnata** L. Passion flower. Dry soil. O. S. A troublesome weed when entering gardens and fields. Fl. May. Fruit in August. Called "May pops."

*P. lutea* L. Yellow passion flower. Thickets. O. S. May-July.

CACTACEÆ Lindl.

OPUNTIA Mill.

*Opuntia Opuntia* (L.) Coulter. *O. vulgaris* Mill. Eastern prickly pear. A waif near a railroad station. Lavergne. Common on the Atlantic Coast. June, July.

*O. humifusa* Raf. *O. Rafinesquii* Engelm. Western prickly pear. Abundant in rocky glades. O. S. Varying with orbicular and obovate joints. June, July.

THYMELEACEÆ Reichenb.

DIRCA L.

*Dirca palustris* L. Leatherwood. Moosewood. Swampy or moist thickets in the Alleghany and Cumberland Mts. April, May.

LYTHRACEÆ Lindl.

AMMANIA L.

*Ammania coccinea* Rottb. Swamps or ditches. O. S. July-September.

*A. latifolia* L. Wet places. Tullahoma, etc. July, August.

DIDIPLIS Raf.

*Didiplis diandra* Wood. *D. linearis* Raf. O. S. June-August.

ROOTALA L.

*Rotala ramosior* (L.) Kœhne. *Ammania humilis* Michx. Pools and ditches. O. S. July-September.

DECODON J. T. Gmelin.

*Decodon verticillatus* (L.) Ell. *Nesaea verticillata* H. B. K. Loosestrife. Waters of Barren Fork of Caney Fork, near Nicholson Springs. September.

LYTHRUM L.

*Lythrum alatum* Pursh. Angled loosestrife. Borders of springs and rivulets. Cleveland, E. Tenn. July.

PARSONIA P. Br. (Cuphaea Jacq.)

*Parsonia petiolata* (L.) Rusby. *Cuphaea viscosissima* Jacq. Clammy cuphaea. Tar weed. Dry woods. O. S. August, September.

## MELASTOMACEÆ R. Br.

## RHEXIA L.

*Rhexia Mariana* L. Maryland meadow beauty. Wet lands. O. S. July.

*Rh. Virginica* L. Meadow beauty. Low grounds. O. S. July-September.

## LAGERSTROEMIA L.

*Lagerstroemia Indica* L. The crêpe myrtle. Frequently cultivated. Ornamental shrub. From E. India.

## PUNICA L.

*Punica Granatum* L. From S. Europe and N. Africa. Cultivated, but frequently killed by hard frosts; belongs to this family.

## ONAGRACEÆ Dumort.

## ISNARDA L.

*Isnarda palustris* L. *Ludwigia palustris* Ell. Marsh purslane. Ponds and ditches. O. S. June-November.

## LUDWIGIA L.

*Ludwigia linearis* Walt. Bogs and pools. O. S. July-September.

*L. hirtella* Raf. Tullahoma. Paradise Ridge. June-September.

*L. alternifolia* L. Rattle box. Ponds. O. S. June-September.

*L. glandulosa* Walt. *L. cylindrita* Ell. Oak barrens. O. S. August.

*L. polycarpa* Short & Peter. Swamps. O. S. July-October.

*L. natans* Ell. Ponds. O. S. July-September.

## JUSSIAEA L.

*Jussiaea diffusa* Forskl. *J. repens* Sw. Swamps near Nashville. June-August.

*J. decurrens* (Walt.) DC. In swamps. O. S. July-September.

## EPILOBIUM L.

*Epilobium coloratum* Mühl. Purple-leaved willow herb. Burnt grounds. O. S. July-September.

## ONAGRA Adans.

*Onagra biennis* (L.) Scop. (*Enothera biennis* L. Evening

primrose. O. S. Dry soil. Naturalized from Europe. June-October.

*O. biennis grandiflora* (Ait.) Small. Scattering over the same range with the former.

### ŒNOTHERA L.

*Œnothera laciniata* Ell. (*Œ. sinuata* L. Near Hyde's Ferry. Nashville. May, June.

*Œ. linearis* Michx. E. Tenn. Marion, S. W. Va. J. K. Small.

### KNEIFFIA Spach. (*Œnothera* L.)

*Kneiffia linearis* (Michx.) Spach. (*Œnothera linearis* Michx. E. Tenn. Marion, S. W. Va. J. K. Small.

*K. pumila* (L.) Spach. (*Œnothera pumila* L. Mts. of E. Tenn. Ocoee Valley. Tullahoma. June-August.

*K. fruticosa* (L.) Raimann. (*Œnothera fruticosa* L. Common sundrops.

*K. fruticosa* var. *hirsuta* Nutt. Cleveland, Bradley County.

*K. glauca* (Michx.) Spach. (*Œnothera glauca* Michx. Lookout Mt. Frog Mts., E. Tenn. May-September.

### HARTMANNIA Spach. (*Œnothera* L.)

*Hartmannia speciosa* (Nutt.) Small. (*Œnothera speciosa* Nutt. Showy primrose. Unoccupied town lots. Escaped from gardens. Nashville. May-July.

### LAVAUXIA Spach. (*Œnothera* L.)

*Lavauxia triloba* (Nutt.) Spach. (*Œnothera triloba* Nutt. Open grounds around Nashville. Frequent. May-July.

### GAURA L.

*Gaura biennis* L. Cumberland Mts. E. Tenn. July-September.

*G. Michauxii* Spach. *G. filipes* Spach. Chattanooga. Dr. G. Engelman. July, August.

### CIRCAEA L.

*Circaea Lutetiana* L. Bind weed. Night shade. Woods. O. S. June-August.

*C. alpina* L. High summits of the Alleghanies, E. Tenn. July-September.

### HALLORAGIDACEÆ.

#### PROSERPINACA L.

*Proserpinaca palustris* L. Mermaid weed. Swamps. O. S. July.

*P. pectinacea* Lam. Ditches along the railroad at Tullahoma. Summer.

### MYRIOPHYLLUM L.

*Myriophyllum verticillatum* L. Water milfoil. Tullahoma Creek, Tullahoma. May.

*M. pinnatum* (Walt.) B. S. P. *M. scabratum* Michx. Haywood County. S. M. Baine.

### ARALIACEÆ Vent.

#### ARALIA L.

*Aralia spinosa* L. Angelica tree. Frequent in rocky hills and glades. O. S. June-August. *M.*

*A. racemosa* L. American spikenard. E. Tenn. and highlands of M. Tenn. Charlotte Pike, two miles from Nashville. July, August. *M.*

*A. hispida* Vent. Bristly sarsaparilla. Throughout the mountains of E. Tenn. Frog Mts. June, July. *M.*

*A. nudicaulis* L. Sewanee. June, July. *M.*

#### PANAX L.

*Panax quinquefolium* L. Ginseng. Rich woodlands. O. S., but scarce. In the Harpeth hills, south of Nashville. July, August. *M.*

### UMBELLIFERÆ B. Juss.

#### DAUCUS L.

*Daucus Carota* L. Wild carrot. The mother plant of the garden carrot. Introduced, naturalized, and growing more robust here than in its native home in Germany. June-September. *M.*

#### ANGELICA L. (Archangelica Hoffm.)

*Angelica Curtisii* Buckl. Roane Mt. Chickering.

*A. villosa* (Walt.) B. S. P. *Angelica hirsuta* Mühl. Angelica. Dry barrens. O. S. July, August.

#### OXYPOLIS Raf. (Archemora DC.)

*Oxypolis rigidus* (L.) Britton. *Archemora rigida* DC. Cowbane. Woodlands. O. S. August, September.

#### HERACLEUM L.

*Heracleum lanatum* Michx. Cow parsnip. High mountains of E. Tenn. June. *M.*

**PASTINACA L.**

*Pastinaca sativa* L. Parsnips. Native of Britain and Germany. Cultivated and naturalized. In moist woodlands. O. S. June-September. *M.*

**POLYTÆNIA DC.**

*Polytænia Nuttallii* DC. Baker's Station, Paradise Ridge, Robertson County. April, May.

**THASPIUM Nutt.**

*Thaspium trifoliatum* (L.) Britton. *Th. atropurpureum* Nutt. Purple meadow parsnip. In woods. O. S.

*Th. trifoliatum aureum* Britton. *Th. aureum* Nutt. O. S. June, July. *M.*

*Th. barbinode* (Michx.) Nutt. Woods. O. S. July, August.

*Th. barbinode angustifolium* Coult. & Rose. Barrens of M. Tenn. Frequent. May.

*Th. pinnatifidum* (Buckl.) A. Gray. In similar localities like the former. May, June.

**LIGUSTICUM L.**

*Ligusticum Canadense* (L.) Britton. *L. actæifolium* Michx. Lookout Mt. Roane Mt. June-August.

**ERYNGIUM L.**

*Eryngium aquaticum* L. *E. yuccæfolium* Michx. Rattlesnakemaster. Dry uplands. O. S. June-September. *M.*

*E. Virginicum* Lam. Near Mt. Mitchell. A. Ruth.

*E. prostratum* Nutt. Low grounds. Brownsville, W. Tenn.

*E. virgatum* Lam. Henderson, W. Tenn. S. M. Bain.

**SANICULA L.**

*Sanicula Marylandica* L. Black snakeroot. Moist woods. O. S. May-July. *M.*

*S. Canadensis* L. *S. Marylandica* var. *Canadensis* Torr. Woods. O. S. June-August. *M.*

*S. gregaria* Bicknell and

*S. trifoliata* Bicknell are likely to occur within the State.

**FÆNICULUM Adans.**

*Fœniculum Fœniculum* (L.) Karst. *F. vulgare* Gært. Fennel. In waste places. Escaped from gardens. O. S. July-September. *M.*

*F. dulce* Gært. Sweet fennel. Sometimes cultivated. Yields. *Oleum Fœniculi*. July. *M.*

### PIMPINELLA L.

*Pimpinella integerrima* (L.) Asa Gray. *Zizia integerrima* DC. Yellow pimpinell. From the high mountains to the rocky banks of the rivers. O. S. May, June.

*P. Anisum* L. Anis. Sometimes cultivated. The seeds yield the *Ol. Anisi*. June. *M.*

### APIASTRUM Nutt. (*Leptocaulis* Nutt.)

*Apiastrum patens* (Nutt.) Coulter & Rose. *Leptocaulis patens* Nutt. Knoxville. A. Ruth. June.

### EULOPHUS Nutt.

*Eulophus Americanus* Nutt. Thickets along Charlotte and Murfreesboro Pikes, Nashville. May, June.

### ANTHRISCUS Hoffm.

*Anthriscus Cerefolium* (L.) Hoffm. *Chærophyllum sativum* Lam. Garden chervil. Cultivated as a pot herb, and sometimes escaped. May, June.

### BUPLEURUM L.

*Bupleurum rotundifolium* L. Thorough wort. Fort Negley, Nashville. Cedar glades. Naturalized from Europe. June, July.

### CHÆROPHYLLUM L.

*Chærophyllum procumbens* (L.) Crantz. Wild chervill. Moist, rock woodlands. Nashville. April-June.

*Ch. Teinturieri* Hook. Characteristic of the cedar glades of M. Tenn. March-May.

### WASHINGTONIA Raf. (*Osmorrhiza* Raf.)

*Washingtonia Claytoni* (Michx.) Britt. *Osmorrhiza brevistylis* DC. Sweet cicely. Along Holston River, S. W. Va. J. K. Small.

*W. longistylis* (Torr.) Britton. Smooth sweet cicely. *Osmorrhiza longistylis* DC. Rich woods. O. S. Nashville. April, May. *M.*

### SIUM L.

*Sium cicutæfolium* Gmel. Hemlock. Water parsnip. Marion, W. Va. J. K. Small. July, August.

## APIUM L.

*Apium Petroselinum* L. Common or garden parsley. Cultivated in kitchen gardens, and sometimes escaped. July, August.

*A. graveolens* L. Celery. Cultivated, escaping into waste places. May-July. *M.*

## ZIZIA Koch.

*Zizia aurea* (L.) Koch. *Thaspium aureum* var. *apterum* A. Gray. Golden meadow parsnip. Rocky glens and hillsides. O. S. May.

*Z. Bebbii* (Coult. & Rose) Britton. Mts. of E. Tenn. May.

*Z. cordata* (Walt.) DC. *Thaspium trifoliatum* var. *apterum* A. Gray. O. S. May, June.

## CARUM L.

*Carum Carvi* L. Caraway. Adventive from Europe, sometimes appearing in fields, near dwellings. May-July. *M.*

## CICUTA L.

*Cicuta maculata* L. Water hemlock. Musquash root. Along streams. O. S. July. *M.*

DERINGA Adans. (*Cryptotænia* DC.)

*Deringa Canadensis* (L.) Kuntze. *Cryptotænia Canadensis* DC. Housewort. Low, damp woods. O. S. June, July.

SPERMOLEPIS Raf. (*Leptocaulis* Nutt.)

*Spermolepis divaricatus* (Walt.) Britton. *Leptocaulis divaricatus* DC. Occasionally found in pastures. Nashville. April, May.

PTILIMNIUM Raf. (*Discopleura* DC.)

*Ptilimnium capillaceum* (Michx.) Hollick. Mock bishop weed. A single plant found in Nashville. July.

*P. Nuttallii* (DC.) Britton. *Discopleura Nuttallii* DC. Damp woods east of Cleveland, Bradley County. July.

## HYDROCOTYLE L.

*Hydrocotyle umbellata* L. Marsh pennywort. Ditches near Hyde's Ferry, Nashville. June-September.

*H. Americana* L. Polk County. E. Tenn. June-September.

*H. ranunculoides* L. fil. Tullahoma Creek, Coffee County. June.

**ERIGENIA** Nutt.

*Erigenia bulbosa* (Michx.) Nutt. Harbinger of spring. O. S. March, April.

**CORIANDRUM** Hoffm.

*Coriandrum sativum* L. Cumin. Used as a condiment, and hence escaping into garden plots. M.

**CUMINUM** L.

*Cuminum sativum* L. Cumin. A condiment. Sparsely escaping into open grounds.

**CORNACEÆ** Link.**CORNUS** L.

*Cornus florida* L. Flowering dogwood. O. S. March, April.

*C. Amonum* Mill. *C. sericea* L. Kinnikiniks. Moist grounds. O. S. May-July.

*C. asperifolia* Michx. Along streams. O. S. May, June.

*C. stolonifera* Michx. Red osier dogwood. Banks of streams. O. S. May, June.

*C. alternifolia* L. fil. Copses and hillsides. E. Tenn. May, June.

**NYSSA** L.

*Nyssa sylvatica* Marsh. *N. multiflora* Wang. Sour gum. Low, moist grounds. Medium-sized tree, 30 to 35 feet high. O. S. April-June.

*N. biflora* Walt. *N. sylvatica* var. *biflora* Sargt. N. Carolina Poir. Along mountain streams, E. Tenn., and in swamps in W. Tenn. Hollow Rock. April, May.

*N. aquatica* L. *N. uniflora* Wang. Large tupelo gum. Large tree, frequently 80 to 100 feet high in the lowlands of W. Tenn. Also on uplands on Paradise Ridge, near Nashville. April, May.

**CLETHRACEÆ** Klotsch.**CLETHRA** L.

*Clethra acuminata* Michx. Mountain sweet pepper bush. Throughout the Alleghanies. July, August.

**PYROLACEÆ** Agardh.**PYROLA** L.

*Pyrola rotundifolia* L. Round-leaved wintergreen. Mts.

of E. Tenn. South fork of Holston River. J. K. Small. June, July.

*P. elliptica* Nutt. Wolf Creek, Cocke County. June, July.

### CHIMAPHILA Pursh.

*Chimaphila maculata* (L.) Pursh. Pipsissawa. Dry woods, especially under pines. O. S. June-August.

*Ch. umbellata* (L.) Nutt. Prince's pine. Tracy City. July.

### MONOTROPACEÆ Lindl.

**MONOTROPSIS** Schwein. (Schweinitzia Nutt.)

*Monotropis odorata* Ell. Schweinitzia odorata DC. Sweet pine sap. Rugby. Mrs. M. L. Percival. February-May.

### MONOTROPA L.

*Monotropa uniflora* L. Indian pipe. In leaf-mold. O. S. Nashville. Harpeth hills. June-August.

### HYPOPITIS Adans.

*Hypopitis Hypopitis* (L.) Small. *Monotropa Hypopitis* L. False beechdrops. Cumberland Mts. Oakdale Station. June-October.

### ERICACEÆ DC.

#### AZALEA L.

*Azalea nudiflora* L. Wild honeysuckle. Siliceous soils. O. S. April, May.

*A. lutea* L. *A. calendulacea* Michx. Azalea. Cumberland and Alleghany Mts. Ravines in the valleys. In argillaceous or siliceous soils.

*A. arborescens* Pursh. Tree-Azalea. Sometimes a small tree 20 feet high. Big Frog Mts. Head of Piney Creek, in the Cumberland Mts. Mrs. L. Bennett. June.

*A. viscosa* L. *Rhododendron viscosum* Torr. Swamp honeysuckle. Along mountain streams in the Alleghanies. Parksville, Polk County. June, July.

#### RHODODENDRON L.

*Rhododendron maximum* L. Great laurel. Attaining sometimes the size of a tree 25 to 30 feet high by 1 m. diameter. Big Frog Mts. Over the Cumberland and Alleghany Mts. June, July.

*Rh. Catawbiense* Michx. Mountain rose bay. Summit of Smoky Mts. Roane Mt. Wolf Creek. July, August.

*Rh. punctatum* Andr. Along Little River, E. Tenn. Chs. Hill. Wolf Creek. A. Ruth.

**MENZIESIA** J. E. Smith.

*Menziesia pilosa* (Michx.) Pers. *M. globularis* Salisb. High mountains of E. Tenn. Clingman Dome. Roane Mt. May, June.

**DENDRIUM** Desv. (*Leiophyllum* Pers.)

*Dendrium buxifolium* (Berg.) Desv. Sand myrtle. *Leiophyllum buxifolium* Ell. Summit of Roane Mt. Chickering. April-June.

**KALMIA** L.

*Kalmia latifolia* L. Calico bush. Mts. of E. Tenn. and highlands of M. Tenn. Always in siliceous soils. May, June.

**LEUCOTHOE** D. Don.

*Leucothoe Catesbaei* (Walt.) A. Gray. Common along streams in the Cumberland and Alleghany Mts. April, May.

*L. recurva* (Buckl.) A. Gray. With the former. May, June.

*L. racemosa* (L.) A. Gray. Along Emory River, Roane County. T. H. Kearney. Along French Broad River. April-June.

**PIERIS** D. Don. (*Andromeda* Pursh.)

*Pieris floribunda* (Pursh.) Benth. & Hooker. *Andromeda floribunda* Pursh. Mountain fetter bush. High mountains of E. Tenn. May.

*P. Mariana* (L.) Benth. & Hook. Cumberland and Alleghany Mts. May-July.

**XOLISMA** Raf. (*Lyonia* Nutt.)

*Xolisma ligustrina* (L.) Britton. *Andromeda ligustrina* Mühl. *Lyonia ligustrina* DC. Privet *Andromeda*. Big Frog Mts., E. Tenn. July.

**OXYDENDRUM** DC.

*Oxydendrum arboreum* (L.) DC. Sour wood. Tree reaching 50 to 60 feet. Frequent in siliceous soils. O. S. June, July.

**EPIGÆA** L.

*Epigæa repens* L. Trailing arbutus. Ground laurel. Cumberland and Alleghany Mts. March-May.

**GAULTHERIA** L.

*Gaultheria procumbens* L. Wintergreen. Mts. of E. Tenn. Abundant. June-September.

## VACCINIACEÆ Lindl.

## GAYLUSSACIA H. B. K.

*Gaylussacia frondosa* (L.) T. & G. *Vaccinium frondosum* L. Dangleberry. Mts. of E. Tenn. May, June. Fruit in July, August.

*G. resinosa* (Ait.) T. & G. *Vaccinium resinosum* Ait. Black or high-bush huckleberry. Siliceous soils. O. S. May, June. Fruit in July, August.

*G. brachycera* (Michx.) A. Gray. *Vaccinium brachycerum* Michx. Box huckleberry. Slopes of the Alleghanies. Parksville, on Ocoee River. May.

*G. ursina* (M. A. Curtis) T. & G. Bear huckleberry. A few miles southeast from Ducktown, in Georgia.

## VACCINIUM L.

*Vaccinium virgatum tenellum* (Ait.) A. Gray. Southern black huckleberry. Paradise Ridge, Davidson County. April, May. Fruit in July.

*V. corymbosum* L. High-bush blueberry. Gravelly hills. O. S. May, June. Fruit in July.

*V. vacillans* Kalm. S. W. Va. J. K. Small. May, June. Fruit in July, August.

*V. pallidum* Ait. *V. Constablei* A. Gray. Mts. of E. Tenn. May, June. Fruit in July.

*V. melanocarpum* Chas. Mohr. n. sp. Bluff Mt., Cocke County. T. H. Kearney. May.

*V. stamineum* L. Deerberry. Dry woods and thickets. O. S. April-June.

*V. arboreum* Marsh. Farkleberry. Siliceous soils. O. S. May, June.

*V. hirsutum* Buckl. Frog Mts. Sugar Loaf Mt. at Parksville, Polk County, with *Gaylussacia brachycera*. May, June.

## OXYCOCCUS Hill.

*Oxycoccus macrocarpus* (Ait.) Pers. *Vaccinium macrocarpum* Ait. American cranberry. Swamp at Cranberry Mines, on Tennessee and North Carolina State line. June-August. Fruit in October.

*O. erythrocarpus* (Michx.) Pers. *Vaccinium erythrocarpum* Michx. Southern mountain cranberry. High mountains of E. Tenn. June, July. Fruit in September.

## DIAPENSIACEÆ Link.

## GALAX L.

*Galax aphylla* L. Colt's foot. Throughout the Alleghanies. May-July.

## PRIMULACEÆ Vent.

**SAMOLUS L.**

*Samolus floribundus* H. B. K. *S. Valerandi* var. *Americanus* A. Gray. Water pimpernell. Wet places. O. S. May-September.

**LYSIMACHIA L.**

*Lysimachia Fraseri* Duby. Golden Loosestrife. Lookout Mt. Cliffs along Ocoee River. June, July.

*L. quadrifolia* L. Crosswort. Woodlands. O. S. June-August.

*L. Nummularia* L. Moneywort. Naturalized from Europe. Escaped from gardens. May, June.

**STEIRONEMA Raf.**

*Steironema ciliatum* (L.) Raf. Moist thickets. O. S. June-August.

*S. tonsum* (Wood) Bicknell. *S. intermedium* Kearney. Mts. of E. Tenn. T. H. Kearney.

*S. tonsum simplex* Kearney. Wolf Creek. T. H. Kearney. June, July.

*S. radicans* (Hook.) A. Gray. Henderson, W. Tenn. S. M. Bain. June-August.

*S. lanceolatum* A. Gray. O. S. June, July.

*S. quadriflorum* (Sims) Hitchc. *S. lanceolatum* var. *angustifolium* A. Gray. Bradley County, E. Tenn. Cumberland Mts. June, July.

**ANAGALLIS L.**

*Anagallis arvensis* L. Pimpernell. Naturalized from Europe. Scatteringly O. S. May, June. *M.*

*A. coerulea* L. Grass plots in Nashville (Blind School). May, June.

**CENTUNCULUS L.**

*Centunculus minimus* L. Chaff weed. Hilltops along Harding Pike, twelve miles west of Nashville. Abundant. April, May.

**DODECATHEON L.**

*Dodecatheon Meadia* L. Shooting star. The purple flowering variety in E. Tenn. The white exclusively in vicinity of Nashville. April, May.

## SAPOTACEÆ Reichenb.

**BUMELIA Sw.**

*Bumelia lycioides* (L.) Pers. Southern buckthorn. Shrub

or small tree. M. Tenn. and southern part of E. Tenn. In moist, rich soil. June-August.

## EBENACEÆ Vent.

## DIOSPYROS L.

*Diospyros Virginiana* L. Persimmon. Sometimes reaching 80 to 100 feet in height by 3 to 4 feet diameter. O. S. May, June. Fruit in September, November.

## SYMPLOCACEÆ Miers.

## SYMPLOCOS L.

*Symplocos tinctoria* (L.) L'Her. Sweet-leaf horse sugar. Near Ducktown, Polk County, in North Carolina. March, April.

## STYRACEÆ A. DC.

## STYRAX L.

*Styrax Americana* Lam. Smooth storax. Jackson, W. Tenn. S. M. Bain. March, April.

## MOHRODENDRON Britt. (Halesia Ellis.)

*Mohrodendron Carolinum* (L.) Britton. Halesia tetraptera L. Snowdrop tree. O. S. Along streams. Ocoee Valley. March, April.

*M. dipterum* (L.) Britton. Halesia diptera. Grounds of St. Cecilia Academy, Nashville. Cultivated. April.

## OLEACEÆ Lindl.

## SYRINGA L.

*Syringa vulgaris* L. Lilac. Frequently cultivated, and sometimes remaining on deserted garden plots. Native of Europe. April, May.

## FRAXINUS L.

*Fraxinus Americana* L. White ash. O. S. Attaining over 100 feet by 3 to 5 feet diameter.

*F. lanceolata* Borck. *F. viridis* Michx. Green ash. Growing to 65 feet by 3 feet diameter. Low, moist grounds. Frequent about Nashville. April, May.

*F. Pennsylvanica* Marsh. *F. pubescens* Law. Swamps and low grounds. O. S. April, May.

*F. quadrangulata* Michx. Blue ash. Large tree, attaining sometimes 110 feet by 3 feet diameter. O. S. March, April.

*F. Americana* var. *microcarpa* A. Gray. Frequent in the

Harpeth hills, near Nashville. Is a hybrid between *F. Americana* and *viridis*. Its copious seeds are sterile. March, April.

**ADELIA** P. Br. (*Forestiera* Poir.)

*Adelia acuminata* Michx. *Forestiera acuminata* Poir. At the water's edge of Cumberland River and its tributaries. March, April.

*A. ligustrina* Michx. *Forestiera ligustrina* Poir. A shrub characteristic of the cedar glades of M. Tenn. July. Fruit in October.

**LIGUSTRUM** L.

*Ligustrum vulgare* L. Privet. Used for hedges. Native of Europe, but well naturalized and producing perfect fruits. June, July.

LOGANIACEÆ Dumort.

**GELSEMIUM** Juss.

*Gelsemium sempervirens* (L.) Ait. f. Yellow jessamine. Lookout Mt. Frequent in the southern part of M. Tenn. March-October.

**SPIGELIA** L.

*Spigelia Marylandica* L. Pink root. O. S. May, June.

**CYNOCTONUM** J. G. Gmelin. (*Mitreola* R. Br.)

*Cynoctonum Mitreola* (L.) Britton. *Mitreola petiolata* T. & Gray. Mitrewood. Near Kingston Springs. J. M. Bain. June-September.

**POLYPREMUM** L.

*Polypremum procumbens* L. Sandy soil. Scattering O. S. May-September.

GENTIANACEÆ Dumort.

**SABBATIA** Adans.

*Sabbatia lanceolata* (Walt.) Torr. & Gray. Elizabethtown, E. Tenn. May-September.

*S. angustifolia* (Michx.) Britton. *S. brachiata* Ell. Century. Barrens. O. S. June, July. *M.*

*S. angularis* (L.) Pursh. Rose pink. Pastures in rich soil. O. S. July, August. *M.*

*S. campanulata* (L.) Torr. *S. gracilis* Pursh. Slender marsh pink. Barrens at Tullahoma. July. *M.*

**GENTIANA L.**

*Gentiana quinquefolia* L. Stiff gentian. Frog Mts., Polk County. Hills around the copper mines. August, September.

*G. Saponaria* L. Soapwort gentian. Moist thickets in the highlands. September, October. *M.*

*G. Andrewsii* Griesebach. Closed gentian. Highlands. South Tunnel. August, September.

*G. villosa* L. *G. ochroleuca* Fröehl. Stringed gentian. Barrens. O. S. September, October. *M.*

**FRASERA Walt.**

*Frasera Carolinensis* Walt. American Columbo. Barrens. O. S. June-August. *M.*

**OBOLARIA L.**

*Obolaria Virginica* L. Pennywort. Moist, rich woodlands. O. S. Paradise Ridge. Sequatchie Valley.

**BARTONIA Mühlb.**

*Bartonia Virginica* (L.) B. S. P. *B. tenella* Willd. Mountain bogs. Sewanee. July-September.

**MENYANTHACEÆ G. Don.****LIMNANTHEMUM S. G. Gmelin.**

*Limnanthemum lacunosum* Griesb. Floating heart. Cypress swamps. W. Tenn. July, August.

**APOCYNACEÆ Lindl.****. AMSONIA Walt.**

*Amsonia Amsonia* (L.) Britton. *A. Tabernæmontana* Walt. Including *A. latifolia* Michx. and *A. salicifolia* Pursh. O. S. In moist soil. May, June.

**VINCA L.**

*Vinca minor* L. Periwinkle. On all old graveyards. Matures and propagates from seed. Introduced from Europe. March-May.

**APOCYNUM L.**

*Apocynum androsæmifolium* L. Spreading dogbane. O. S. July, August. *M.*

*A. cannabinum* L. Indian hemp. O. S. June-August. *M.*

**TRACHELOSPERMUM** Lemaire.

*Trachelospermum difforme* (Walt.) A. Gray. *Forsteronia difformis* A. DC. Haywood County, W. Tenn. S. M. Bain.

## ASCLEPIADACEÆ Lindl.

**ASCLEPIAS** L.

*Asclepias tuberosa* L. Butterfly weed. Pleuresy root. Fields and pastures. O. S. June, July. *M.*

*A. purpurascens* L. Purple milk weed. Edges of woods and fields. O. S. June, July.

*A. incarnata* L. Swamp milk weed. Swamps. O. S. June, July.

*A. incarnata* L. Var. *longifolia* Gray. Swamps along Cumberland River. *M.*

*A. obtusifolia* Michx. Ocoee District. Rugby. Mrs. Percival. June, July.

*A. exaltata* (L.) Mühl. *A. phytolaccoidea* Pursh. Mts. of E. Tenn. July.

*A. variegata* L. White milk weed. Dry uplands, Nashville. E. Tenn. June, July.

*A. quadrifolia* Jacq. Oak barrens of M. Tenn. June, July.

*A. Syriaca* L. Silk weed. A. Cornuti Decaisne. O. S. July. *M.*

*A. perennis* Walt. Bottoms, W. Tenn., at Henderson. S. M. Bain. May-August.

*A. verticillata* L. Whorled milk weed. Frequent in the cedar glades. July.

**ASCLEPIODORA** A. Gray.

*Asclepiodora viridis* (Walt.) A. Gray. Cedar glades. In dry, open places. May-July.

**ACERATES** Ell.

*Acerates viridiflora* (Raf.) Eaton. Cedar glades, Lavergne. June, July.

*A. longifolia* Ell. A. Floridana Hitch. Barrens at Tullahoma. July, August.

**AMPELANUS** Raf. (Britton *Ensenia* Nutt.)

*Ampelanus albidus* Nutt. *Britton Ensenia albida* Nutt. Sand vine. Thickets and along river banks. O. S. July.

**VINCETOXICUM** Walter. (*Gonolobus* Michx.)

*Vincetoxicum gonocarpon* Walt. *Gonolobus lævis* var. *macrophyllus* A. Gray. *G. macrophyllus* Michx. O. S. July.

**V. hirsutum** (Michx.) Britton. *G. hirsutus* Michx. Thickets along Cumberland River and Stoner's Creek. June, July.

**V. obliquum** (Jacq.) Britton. *Gonolobus obliquus* R. Br. Copses around Nashville.

**V. Carolinense** (Jacq.) Britton. *Gonolobus Carolinensis* R. Br. Vicinity of Nashville. May, June.

**V. Shortii** (A. Gray) Britton. *Gonolobus Shortii* A. Gray. E. Tenn. July.

### CONVOLVULACEÆ Vent.

#### EVOLVULUS L.

**Evolvulus pilosus** Nutt. *E. argenteus* Pursh. Cedar glades, Lavergne. May-July.

#### QUAMOCLIT Mœnch.

**Quamoclit Quamoclit** (L.) Britton. *Ipomœa Quamoclit* L. Cypress vine. Immigrant from S. America. Frequent in cornfields and in gardens. July-October.

#### IPOMŒA L.

**Ipomœa pandurata** (L.) Meyer. Wild potato vine. Man of the earth. Dry soil. Along hedges. May-September. *M.*

**I. lacunosa** L. Small-flowered white morning-glory. Moist soil. O. S. July-September.

**I. purpurea** (L.) Roth. Morning-glory. Adventive from tropical S. America. Frequent in cultivation, and naturalized. O. S. July-October.

**I. hederacea** Jacq. Ivy-leaved morning-glory. Fields and waste places. O. S. June-October.

**I. Batatas** Lam. *Batatas edulis* Choix. Sweet potato. Native of S. America. In cultivation only.

#### CONVOLVULUS L.

**Convolvulus sepium** L. Great bind weed. Fields and thickets. O. S. June-August.

**C. repens** L. *C. sepium* var. *repens* Gray. Old fields. South fork of Holston River. J. K. Small. July, August.

**C. spithameus** L. *Calystegia spithamea* Pursh. Dry, rocky woods. Frequent in the Alleghanies. July-September.

**C. arvensis** L. Small bind weed. Grass plots in the city of Nashville, Normal College grounds. June-August.

### CUSCUTACEÆ Dumort.

#### CUSCUTA L.

**Cuscuta arvensis** Beyrich. Field dodder. Near Nashville, on ambrosia. July, August.

*C. chlorocarpa* Engelm. A. Gray. On polygonums and other herbs. O. S. July-September.

*C. indecora* Choisy. *C. decora* Engelm. On solidago and asters. Nashville. Knoxville.

*C. tenuiflora* Engelm. Big Frog Mt. E. Tenn. July.

*C. Gronovii* Willd. On shrubs and herbs. O. S. August, September.

*C. rostrata* Shuttlew. Summit of Thunderhead, on solidago glomerata. July.

*C. compacta* Juss. On eupatorium and other herbaceous plants. Paradise Ridge. Sumner County. August, September.

*C. paradoxa* Raf. *C. glomerata* Choisy. Low bushes, highlands, Sumner County. July.

*C. obtusiflora* H. B. K. Var. *glandulosa* Engelm. On bushes and herbaceous plants. Frequent about Nashville. July, August.

#### POLEMONIACEÆ DC.

##### PHLOX L.

*Phlox paniculata* L. Garden phlox. Rich, moist woodlands. O. S. July-September.

*P. maculata* L. Wild sweet William. With the former. Very common in the Alleghanies. July-September.

*P. glaberrima* L. Mts. of E. Tenn. Highlands of M. Tenn.

*P. glaberrima* L. Var. *suffruticosa* Gray. Banks of Cumberland River at Rising Sun Bluff. July.

*P. pilosa* L. Var. *detonsa* Gray. Cliffs on Cumberland River above Nashville. June.

*P. amœna* Sims. Mts. of E. Tenn. and highlands of M. Tenn. Mitchellville, Sumner County. April-June.

*P. divaricata* L. O. S. April, May.

*P. reptans* Michx. Marion, S. W. Va. J. K. Small. Ducktown, Polk County. April, May.

*P. bifida* Beck. Dry ground. Indiana-Tennessee. Fide Illustrated Flora.

*P. Stellaria* A. Gray. Cedar glades, Lavergne. April.

*P. ovata* L. P. Carolina L. South Tunnel, Robertson County. June.

*P. subulata* L. Moss pink. Kate's Mt., S. W. Va., near Tennessee border. J. K. Small. June.

##### GILIA R. & T.

*Gilia coronopifolia* Pers. Standing cypress. Red knobs. McMinn County, E. Tenn. Perhaps strayed from cultivation. July.

## POLEMONIUM L.

*Polemonium reptans* L. Greek valerian. Moist woods. O. S. April, May.

## HYDROPHYLLACEÆ Lindl.

## HYDROPHYLLUM L.

*Hydrophyllum Virginicum* L. Virginia water leaf. Ducktown, Polk County. June.

*H. macrophyllum* Nutt. Damp woods. South Tunnel, Sumner County. June.

*H. appendiculatum* Michx. Frequent in vicinity of Nashville. June.

*H. Canadense* L. Mts. of E. Tenn. June, July.

## NEMOPHILA Nutt.

*Nemophila microcalyx* (Nutt.) T. & M. Copses and ravines. M. Tenn. Frequent around Nashville. Grounds of Vanderbilt University. March, April.

## PHACELIA Juss.

*Phacelia bipinnatifida* Michx. Moist thickets. O. S. April, May.

*P. dubia* (L.) Small. *P. parviflora* Pursh. Rocky glades. Vicinity of Nashville. April-June.

*P. hirsuta* Nutt. On dry ground. Frequent around Nashville. March, April.

*P. Purshii* Buckl. Very frequent in the glades of M. Tenn. April, May.

*P. fimbriata* Michx. Mts. of E. Tenn. White Top Mt., S. W. Va. J. K. Small. May, June.

*P. Bicknellii* J. K. Small. Collected by Mr. Bicknell near city of Nashville, 1894. Is perhaps same as I have taken to be *P. hirsuta* Nutt.

NAMA L. (*Hyrolea* L.)

*Nama affinis* (A. Gray). Kuntze. Hollow Rock, W. Tenn. August.

## BORAGINACEÆ Lindl.

## HELIOTROPIUM L.

*Heliotropium tenellum* (Nutt.) Torr. Cedar glades of M. Tenn. Very copious. July.

*H. Indicum* L. Low, wet grounds. O. S. May-July.

*H. anchusæfolium* Poir. Introduced and spreading in the grounds of Dr. Cheatham, now Belmont. June.

**CYNOGLOSSUM L.**

*Cynoglossum officinale* L. Hound's tongue. Waste grounds. O. S. April, May.

*C. Virginicum* L. Wild gromfrey. Woods. O. S. April, May.

**LAPPULA Mœnch. (Echinosperrnum Sw.)**

*Lappula Lappula* (L.) Karst. *Echinosperrnum Lappula* Lehm. Burseed. Naturalized from Europe. Waste places. Johnsonville. May-September.

*L. Virginiana* (L.) Greene. *Echinosperrnum Virginianum* Lehm. Beggar's ticks. Woods. O. S. June, July.

**MERTENSIA Roth.**

*Mertensia Virginica* (L.) DC. *Pulmonaria Virginica* L. Lungwort. Rich woodlands. O. S. March, April.

**MYOSOTIS L.**

*Myosotis palustris* (L.) Lam. Forget-me-not. Hampton, E. Tenn. May.

*M. laxa* Lehm. Knoxville. A. Ruth. May, June.

*M. Virginica* (L.) B. S. P. *M. Verna* Nutt. Early scorpion grass. Dry hills. O. S. March, April.

**LITHOSPERMUM L.**

*Lithospermum arvense* L. Corn gromwell. Waste places. O. S. April.

*L. officinale* L. Gromwell. Knoxville. A. Ruth. May.

*L. latifolium* Michx. American gromwell. Highlands. In damp woods. South Tunnel, Sumner County. May, June.

*L. canescens* Lehm. Hoary raccoon. Glades of M. Tenn. June, July.

*L. angustifolium* Michx. W. Tenn., near Hickman. June.

*L. tuberosum* Rugel. Dry ridges near Knoxville.

**ONOSMODIUM Michx.**

*Onosmodium Carolinianum* DC. False gromwell. Banks of Holston River, below the Falls. J. K. Small. May-July.

*O. molle* Michx. Abundant in the glades of M. Tenn. April, May.

**SYMPHYTUM L.**

*Symphytum officinale* L. Gromfrey. Old settlements in the mountains of E. Tenn. May, June.

**BORAGO L.**

*Borago officinalis* L. Borage. Escaped from gardens. E. Tenn. June.

**ECHIUM L.**

*Echium vulgare* L. Vipers Bugloss. Upper E. Tenn. May, June.

## VERBENACEÆ J. St. Hil.

**VERBENA L.**

*Verbena officinalis* L. Vervain. Roadsides and old fields. Naturalized from Europe. E. Tenn. June-September.

*V. urticaefolia* L. Pastures and roadsides. O. S. August, September.

*V. hastata* L. Waste ground. O. S. July-September.

*V. angustifolia* Michx. Dry limestone soils. O. S. July-September.

*V. stricta* Vent. W. Tenn. June-September.

*V. bracteosa* Michx. Roadsides, around dwellings. O. S. June, July.

*V. Canadensis* (L.) Britton. *V. Aubletia* Jacq. Cedar glades. May-July.

*V. riparia* Raf. Small & Heller. *V. urticaefolia* var. *riparia*. Britton. Banks of Staley Creek, at Marion; banks of Cedar Creek, S. W. Va. J. K. Small.

**LIPPIA L.**

*Lippia lanceolata* Michx. Fog fruit. Moist soil. O. S. August, September.

**CALLICARPA L.**

*Callicarpa Americana* L. French mulberry. Limestone regions of M. Tenn. June, July.

## LABIATÆ B. Juss.

**TEUCRIUM L.**

*Teucrium Canadense* L. American Germander. Moist thickets. August, September. *M.*

**ISANTHUS Michx.**

*Isanthus brachiatus* (L.) B. S. P. *I. cœruleus* Michx. Rocky slopes of limestone regions of M. Tenn. July-September.

**TRICHOSTEMA L.**

*Trichostema dichotomum* L. Blue curls. Sandy fields. O. S. July, August.

## SCUTELLARIA L.

*Scutellaria lateriflora* L. Mad-dog sculcap. Moist woodlands. O. S. July-September. *M.*

*S. serrata* And. Wood. M. Tenn. Cumberland Mts. R. M. Middleton. May, June.

*S. incana* Mühl. *S. canescens* Nutt. Hills near Nashville. Craggy Hope, Nashville, Chattanooga and St. Louis Railway. June-August.

*S. cordifolia* Mühl. *S. versicolor* Nutt. Hills near Nashville. June, July.

*S. cordifolia* var. *bracteata* Benth. Bluffs on Mill Creek, near Nashville. July.

*S. pilosa* Michx. Hills near Nashville. E. Tenn. July, August.

*S. pilosa hirsuta* (Short) A. Gray. South Tunnel, Sumner County. July.

*S. integrifolia* L. Highlands. Cumberland Mts. May, June.

*S. integrifolia* var. *major* Chap. Parksville, E. Tenn.

*S. parvula* Michx. Cedar glades. May.

*S. campestris* Britton. *S. parvula* var. *mollis* A. Gray. Glades. Baine.

*S. saxatilis* Riddel. Chilhowee Mts., E. Tenn. May-July.

*S. galericulata* L. Mts. of E. Tenn. Ducktown. June-September.

*S. nervosa* Pursh. Swampy woodlands. Sumner County. July.

*S. venosa* T. H. Kearney. Bull. September, 1897. Bluff Mt., E. Tenn.

## MARRUBIUM L.

*Marrubium vulgare* L. White hoarhound. Waste places. Naturalized from Europe. July. *M.*

## AGASTACHE Clay. (Lophanthus Benth.)

*Agastache nepetoides* (L.) Kuntze. *Lophanthus nepetoides* Benth. Catnip. Giant hysop. Woods and thickets. M. Tenn. July-September.

*A. scrophulariæfolia* (Willd.) Kuntze. *Lophanthus scrophulariæfolia* Benth. High mountains of E. Tenn. July.

## MEEHANIA Britt. (Cedronella Benth.)

*Meehania cordata* (Nutt.) Britton. *Cedronella cordata* Benth. Highlands of M. Tenn. May-July.

**NEPETA L.**

*Nepeta Cataria* L. Catnip. Waste places. Naturalized from Europe. July-November. *M.*

**GLECHOMA L.**

*Glechoma hederacea* L. Ground ivy. Shaded, moist grounds. O. S. March-May. *M.*

**PRUNELLA L.**

*Prunella vulgaris* L. Self-heal. Fields and roadsides. O. S. July-September. *M.*

**PHYSOSTEGIA Benth.**

*Physostegia Virginiana* (L.) Benth. False dragon head. Barrens. O. S. July.

**SYNANDRA Nutt.**

*Synandra hispidula* (Michx.) Britton. Moist woods. John Overton's place, near Nashville. March, April.

**GALEOPSIS L.**

*Galeopsis Tetrahit* L. Hemp nettle. Lemon's Gap, E. Tenn. A. Ruth.

**LEONURUS L.**

*Leonurus Cardiaca* L. Motherwort. Waste places. O. S. June-September. *M.*

**LAMIUM L.**

*Lamium amplexicaule* L. Henbit. Weed in fields and gardens. O. S. February, March.

*L. purpureum* L. Red dead nettle. Knoxville. A. Ruth.

*L. maculatum* L. Spotted dead nettle. Troutdale, W. Va. J. K. Small.

**STACHYS L.**

*Stachys aspera* Michx. Hedge nettle. Moist woodlands. O. S. June, July.

*S. tenuifolia* Willd. *S. aspera* var. *glabra* Gray. Banks of Cumberland River, above Nashville. May, June.

*S. cordata* Riddell. Rich hillsides in the Harpeth hills, near Nashville. July.

**BETONICA L.**

*Betonica officinalis* L. *Stachys Betonica* Benth. Betony. Adventitious in cultivated grounds in Nashville. July-September. *M.*

**SALVIA L.**

*Salvia lyrata* L. Lyre-leaved sage. Copses. O. S. April, May.

*S. urticæfolia* L. Woods. O. S. April-June.

*S. officinalis* L. Sage. Cultivated only. *M.*

**MONARDA L.**

*Monarda didyma* L. Oswego tea. Wet places in the higher mountains of E. Tenn. July.

*M. Clinopodia* L. Mts. of E. Tenn. June-August.

*M. fistulosa* L. Wild bergamot. O. S. June-September.

*M. fistulosa* var. *mollis* Benth. Nashville. June-August. *M.*

*M. Bradburiana* Bick. Highlands of M. Tenn. June, July.

*M. punctata* L. Horse mint. Memphis. Dr. Egeling. *M.*

*M. citriodora* Cero. Lemon horse mint. Montgomery Bell Academy grounds, Nashville. June, July.

**BLEPHILIA Raf.**

*Blephilia ciliata* (L.) Raf. Dry soil. O. S. July.

*B. hirsuta* (Pursh.) Torr. Shady grounds along Cumberland River, near Nashville. June-September.

**HEDEOMA Pers.**

*Hedeoma pulegioides* (L.) Pers. American pennyroyal. O. S. June-September. *M.*

**MELISSA L.**

*Melissa officinalis* L. Balm. Cultivated, and escaped from gardens. June. *M.*

**CLINOPODIUM L. (Calamintha Mœnch.)**

*Clinopodium vulgare* L. Calamintha *Clinopodium* Benth. Wild Basil. Knoxville. A. Ruth. *M.*

*C. Nepeta* (L.) Kuntze. Calamintha *Nepeta* Link. Basil Thyme. Dry, rocky grounds. Frequent around Nashville. E. Tenn. July-September.

*C. glabrum* (Nutt.) Kuntze. Calamintha *glabella* var. *Nuttallii* A. Gray. Abounds in the cedar glades. May, June.

*C. glabellum* (Michx.) Kuntze. Calamintha *glabella* Benth. River banks of Tennessee. Fide Illustrated Flora.

**ORIGANUM L.**

*Origanum Majorana* L. Cultivated majoran. June, July. *M.*

**KOELLIA** Mœnch. (*Pycnanthemum* Michx.)

**Koellia flexuosa** (Walt.) MacM. *Pycnanth. linifolium* Pursh. Mountain mint. Siliceous and argillaceous soils. O. S. June, July. *M.*

**K. Virginica** MacM. *P. lanceolatum* Pursh. O. S. August, September.

**K. pilosa** (Nutt.) Britton. *P. muticum* var. *pilosum* Gray. Dickson County. July.

**K. verticillata** (Michx.) Kuntze. *P. Torreyi* Benth. S. W. Va., near Tennessee line. July-September.

**K. clinopodioides** (T. & G.) Kuntze. *P. clinopodioides* T. & G. E. Tenn. Fide A. Gray.

**K. incana** (L.) Kuntze. *Pycnanthemum incanum* Michx. O. S. August-October.

**K. pycnanthemoides** (Leavenw.) Kuntze. *P. Tullia* Benth. Hills west of Nashville. June, July.

**K. albescens** (T. & G.) Kuntze. *P. albescens* T. & G. Parksville, E. Tenn. Also hilltops near Nashville. July-September.

**K. mutica** (Michx.) Britton. *P. muticum* Pers. Oak barrens of Tullahoma. Very abundant. July, August.

**K. montana** (Michx.) Kuntze. *P. montanum* Michx. Big Frog Mt. Clingman Dome.

**THYMUS** L.

**Thymus vulgaris** L. Sweet thyme. Cultivated only. *M.*

**SATUREIA** L.

**Satureia hortensis** L. Summer savory. Cultivated. *M.*

**LYCOPUS** L.

**Lycopus Virginicus** L. Bugle weed. Ponds and ditches. O. S. August, September.

**L. rubellus** Mœnch. Stalked water hoarhound. Swamps. O. S. July-October.

**L. Americanus** Mühl. Cut-leaved water hoarhound. Wet soil. O. S. July-October.

**MENTHA** L.

**Mentha spicata** L. *M. viridis* L. Spearmint. Introduced. Wet grounds. O. S. July. *M.*

**M. Piperita** L. Peppermint. Introduced. July-September. *M.*

**M. rotundifolia** L. Round-leaved mint. South fork of Holston River. J. K. Small. July.

*M. aquatica* L. Water mint. Knoxville. A. Ruth. August-October.

*M. arvensis* L. Field mint. Waste places. Introduced. July-September.

*M. sativa* L. Whorled mint. Knoxville. A. Ruth. September, October.

*M. Canadensis* L. American wild mint. Margin of ponds. O. S. July-October.

### COLLINSONIA L.

*Collinsonia Canadensis* L. Horse balm. Rich woodlands. Frequent in E. Tenn. July-October. *M.*

*C. punctata* Ell. Cumberland Mts. Harpeth hills, along Hillsboro Pike. July.

*C. verticillata* Baldw. Lookout Mt. W. M. Canby. Knox and Loudon Counties. A. Ruth. *M.*

### PERILLA Ard.

*Perilla frutescens* (L.) Britton. *P. ocymoides* L. Native of India. Spreading in M. Tenn. Growing in old farm lands in big patches. July-October.

### SOLANACEÆ Pers.

#### PHYSALODES Bœhm. (Nicandra Adans.)

*Physalodes Physalodes* (L.) Britton. *Nicandra Physalodes* Gärttn. Apple of Peru. In clearings, or a weed in gardens or fields. O. S. July-September.

#### PHYSALIS L.

*Physalis pubescens* L. Sandy soil. Ground cherry. O. S. July-September.

*P. angulata* L. Copses, in rich soil. O. S. July-September.

*P. Philadelphica* Lam. Fields and gardens. O. S. July.

*P. lanceolata* Michx. Prairie ground cherry. Uplands. Cumberland Mts. July, August.

*P. Virginiana* Mill. Cedar glades and woods. O. S. July-September.

#### SOLANUM L.

*Solanum nigrum* L. Black nightshade. Waste ground. O. S. July-October. *M.*

*S. Carolinense* L. Horse nettle. Fields and waste grounds. O. S. May-September. *M.*

*S. rostratum* Dunal. Sand bur. Adventive from the West.

The original food of the potato bug. Nashville and vicinity. July-August.

**S. Dulcamara** L. Nightshade. Bittersweet. Rare as a spontaneous growth. Near dwellings. O. S. June-September. *M.*

**S. tuberosum** L. Potato. In cultivation only. It grows to perfection on the high mountains of E. Tenn. (Big Frog Mt.), where it also matures its seeds.

**S. Melongena** L. Egg plant. In cultivation only.

#### LYCOPERSICON Mill.

**Lycopersicon Lycopersicon.** Solanum Lycopersicon L. Tomato. Sometimes escaped. Largely cultivated.

#### LYCIUM L.

**Lycium vulgare** Dunal. Matrimony vine. Roadsides and waste grounds. O. S. Introduced from Europe. May, June.

#### DATURA L.

**Datura Stramonium** L. Thorn apple. Jamestown weed. O. S. June-September. *M.*

**D. Tatula** L. Purple thorn apple. With the former. O. S. June-September. *M.*

#### NICOTIANA L.

**Nicotiana Tabacum** L. Tobacco. Universally cultivated in several varieties. The finest qualities are grown in the mountain plateaus of E. Tenn. and North Carolina.

#### PETUNIA Juss.

**Petunia violacea** Lindl. Escaped from gardens into waste places. July.

#### CAPSICUM L.

**Capsicum annuum** L. Red pepper. Spanish pepper. Chile pepper. *M.*

**C. fastigiatum** L. Bird pepper. Fruit in shape of a cock's spur. Used in pickles.

**C. frutescens** L. Cayenne pepper. Pods shaped like the last, but larger. Preferred for medicinal purposes. *M.*

**C. grossum** W. Bell pepper. Pods large and less pungent. All these varieties occur under cultivation only.

#### SCROPHULARIACEÆ Lindl.

#### VERBASCUM L.

**Verbascum Thapsus** L. Great mullein. O. S. June-September. *M.*

**V. Blattaria** L. Moth mullen. Waste places. O. S. June-November.

### LINARIA Juss.

**Linaria Linaria** (L.) Karst. *Linaria vulgaris* Mill. Butter and eggs. Fields and fence rows. O. S. June, July. *M.*

**L. Canadensis** (L.) Dumort. Wild toad flax. Lookout Mt. On summit. May-September.

### SCROPHULARIA L.

**Scrophularia Marylandica** L. Figwort. Wood and thickets. O. S. June, July. *M.*

### CHELONE L.

**Chelone glabra** L. Turtle head. Swamps. O. S. July-August. *M.*

**C. Lyoni** Pursh. Mountain bogs in the Alleghanies. July-September.

### PENTSTEMON Soland.

**Pentstemon hirsutus** (L.) Willd. Hairy beard tongue. Dry woods and thickets. O. S. May-July.

**P. Digitalis** (Sweet) Nutt. Glades. July, August.

**P. Pentstemon** (L.) Britton. *P. lævigatus* Solander. Woods and thickets. M. Tenn. June, July.

**P. canescens** Britton. Slope of Kate's Mt., S. W. Va. J. K. Small. May, June.

**P. Smallii** Heller. Frequent in the glades around Nashville. Knoxville. F. L. Scribner.

**P. calycosus** J. K. Small. Bluffs. Tennessee. Bulletin Bot. Club. September, 1898.

### PAULOWNIA Sieb. & Zucc.

**Paulownia tomentosa** (Thunb.) Baill. *P. imperialis* Sieb. & Zucc. Ornamental tree from Japan. Matures its seeds, and is sometimes found in the open country. May-July.

### MIMULUS L.

**Mimulus ringens** L. Monkey flower. Wet ground. O. S. June-September.

**M. alatus** Soland. Ponds and ditches. O. S. June-September.

### CONOBEA Aubl.

**Conobea multifida** (Michx.) Benth. Sandy soil, along streams. Common in M. Tenn. June-September.

**MONNIERA** P. Br. (Herpestis Gært.)

*Monniera acuminata* (Walt.) Kuntze. *Herpestis nigrescens* Benth. Moist places in the barrens of M. Tenn. June-September.

*M. rotundifolia* Michx. Hedge hyssop. Ponds along Cumberland River. June-September.

**GRATIOLA**. L.

*Gratiola Virginiana* L. Clammy hedge hyssop. Miry places. O. S. May-August.

*G. sphærocarpa* Ell. White Cliff Springs, E. Tenn. L. Scribner.

*G. Floridana* Nutt. E. Tenn. Nashville, on the site of the old waterworks. April, May.

*G. ramosa* Walt. Wet lands in the oak barrens at Tullahoma. June, July.

**ILYSANTHES** Raf.

*Ilysanthes gratioloides* (L.) Benth. Wet ground. False pimpnel. O. S.

*I. attenuata* Small. Same range with the former. April, May.

*I. refracta* Benth. Ducktown, E. Tenn. May, June.

**VERONICA** L.

*Veronica Americana* Schwein. American brooklime. Along water courses. O. S. April-September.

*V. officinalis* L. Common speedwell. Jonesboro, E. Tenn. A. Ruth. May.

*V. serpyllifolia* L. Weed in fields and gardens. O. S. April, May.

*V. peregrina* L. Weed in cultivated ground. O. S. April, May.

*V. arvensis* L. Weed among the grass in pastures. Naturalized from Europe. March-May.

**LEPTANDRA** Nutt.

*Leptandra Virginica* (L.) Nutt. *Veronica Virginica* L. Culvers root. Mountains and highlands. O. S. June-September.

**BUCHNERA** L.

*Buchnera Americana* L. Blue hearts. Oak barrens, M. Tenn. June-September.

**AFZELIA** J. G. Gmel. (*Seymeria* Pursh.)

*Afzelia macrophylla* (Nutt.) Kuntze. Mullen fox glove. Rich, alluvial soil. Nashville. July.

*A. tenuifolia* (Pursh.) Kuntze. Copses near Cleveland, E. Tenn.

**DASYSTOMA** Raf. (*Gerardia* L.)

*Dasystoma Pedicularia* (L.) Benth. False fox glove. Siliceous soil. O. S.

*D. Pedicularia* var. *pectinata* Nutt. Harpeth hills, near Nashville. July, August.

*D. flava* (L.) Wood. Cumberland and Alleghany Mts. and barrens of M. Tenn. July.

*D. grandiflora* (Benth.) Wood. Dry woods. E. Tenn. July, August.

*D. lævigata* Raf. Thickets. O. S. July, August.

*D. Virginica* (L.) Britton. *D. quercifolia* Benth. Harpeth hills, Davidson County. July, August.

*D. patula* Chapm. Bluffs of Cumberland River at Nashville. July, August.

**GERARDIA** L.

*Gerardia purpurea* L. In siliceous soils. O. S. July-September.

*G. tenuifolia* Vahl. Harpeth hills. July-September.

*G. tenuifolia asperula* A. Gray. Greenbrier, Robertson County. July-September.

**CASTILLEJA** Mutis.

*Castilleja coccinea* (S.) Sprengel. Painted cup. Bradley County, east of Cleveland. Dickson County. April, May.

**SCHWALBEA** L.

*Schwalbea Americana* L. Chaff seed. Tullahoma. June.

**PEDICULARIS** L.

*Pedicularis Canadensis* L. Lausewort. Dry woodlands. O. S. April-June.

**MELAMPYRUM** L.

*Melampyrum lineare* Lam. *M. Americanum* Michx. Cow wheat. Wolf Creek, E. Tenn. T. H. Kearney. May-July.

*M. latifolium* Mühl. Thunderhead Mt., near summit. July.

## LENTIBULARIACEÆ Lindl.

## UTRICULARIA L.

*Utricularia inflata* Walt. Bladderwort. Jackson. S. M. Bain.

*U. gibba* L. Bogs on summit of Lookout Mt.

*U. biflora* Lam. Swamps near Hollow Rock. July.

## OROBANCHACEÆ Lindl.

## THALESIA Raf. (Aphyllon A. Gray.)

*Thalesia uniflora* (L.) Britton. Aphyllon uniflorum T. & G. One-flowered broomrape. In leaf mold. Parasitic on herbs. April-June.

## OROBANCHE L.

*Orobanche Ludoviciana* Nutt. Aphyllon Ludovicianum A. Gray. Knoxville. F. L. Scribner. June-August.

## CONOPHOLIS Walt.

*Conopholis Americana* (L. f.) Wallr. Squaw root. Damp woods. O. S. June.

## LEPTAMNIUM Raf. (Epipegus Karst.)

*Leptamnium Virginicum* (L.) Raf. Epipegus Virginianus Bart. Parasitic on the roots of beech trees. August-October. *M.*

## BIGNONIACEÆ Pers.

## BIGNONIA L.

*Bignonia crucigera* L. *B. capreolata* L. Cross vine. Climbing high, fastening itself on the bark of trees. April-June.

## TECOMA Juss.

*Tecoma radicans* (L.) DC. Trumpet flower. Climbing or spreading over the fields. July-September. *M.*

## CATALPA Scop.

*Catalpa Catalpa* (L.) Karst. *Catalpa bignonioides* Walt. Frequent in M. Tenn. June, July. *M.*

*C. speciosa* Warder. Frequent in E. Tenn. June, July.

## MARTYNIACEÆ Link.

**MARTYNIA L.**

*Martynia Louisiana* Mill. *Martynia proboscoidea* Glox.  
Waste places. O. S. July-September.

## ACANTHACEÆ J. St. Hil.

**RUELLIA L.**

*Ruellia strepens* L. Dry soil. O. S. May-July.  
*R. ciliosa* Pursh. Barrens. O. S. May-July.

**DIANTHERA L.**

*Dianthera Americana* L. Water and wet grounds. May-August.

*D. humilis* Engelm & Gray. Madison County. S. M. Bain.

**GÆTESIA Gray.**

*Gætesia læte-virens* Gray. Lookout Mt., E. Tenn. July.

**DIAPEDIUM Konig. (Dicliptera Juss.)**

*Diapedium brachiatum* (Pursh.) Kuntze. *Dicliptera brachiatata* Sprengel. Damp woodlands. Nashville. July-October.

## PHRYMACEÆ Schauer.

**PHRYMA L.**

*Phryma leptosyachya* L. Lopseed. Woods and thickets. O. S. June-August.

## PLANTAGINACEÆ Lindl.

**PLANTAGO L.**

*Plantago major* L. Common plantain. Waste grounds. In cities. Not frequent, like the next. May-September.

*P. Rugelii* DC. Very common, and easily distinguished by its very slender spikes. O. S. June-September.

*P. lanceolata* L. Rib grass. Obnoxious intruder into meadows. O. S. April-June.

*P. cordata* Lam. Water plantain. Swamps, W. Tenn. Falls of Holston River, S. W. Va. J. K. Small.

*P. aristata* Michx. *P. Patagonica aristata* Gray. Dry, sandy soils. Tullahoma. Dickson County. May-October.

*P. Virginica* L. O. S. March-May.

*P. elongata* Pursh. *P. pusilla* Nutt. Mitchellville. April, May.

*P. heterophylla* Nutt. Barrens. O. S. April-July.

## RUBIACEÆ B. Juss.

## HOUSTONIA L.

*Houstonia coccinea* L. Bluet. Moist, open ground. O. S. April-June.

*H. serpyllifolia* Michx. Covering the ground on the high summits of the Alleghanies. May.

*H. minor* (Michx.) Britton. *H. patens* Ell. Cedar glades. March, April.

*H. minima* Beck. Knoxville. Fort Saunders. A. Ruth. March, April.

*H. purpurea* L. *Oldenlandia purpurea* A. Gray. O. S.

*H. purpurea* var. *pubescens* Britton. With the former.

*H. purpurea* var. *calycosa*. Similar localities with the former. May-September.

*H. tenuifolia* Nutt. Throughout the mountains of E. Tenn. Wolf Creek. August, September.

*H. angustifolia* Michx. Copiously in the cedar glades. Bluffs of Cumberland River, at Nashville. May-July.

## OLDENLANDIA L.

*Oldenlandia Boscii* Chapm. Ditches along railroad at Tullahoma.

## CEPHALANTHUS L.

*Cephalanthus occidentalis* L. Button bush. Swamps and wet ground. O. S. June-September. *M.*

## MITCHELLA L.

*Mitchella repens* L. Partridge berry. Woods. O. S. April-June. *M.*

## SPERMACOCE L.

*Spermacoce glabra* L. Smooth button weed. Wet soil. O. S. June-September.

## DIODIA L.

*Diodia teres* Walt. Old fields. O. S. July-September.

*D. Virginiana* L. Wet lands, covering fields. June-August.

## GALIUM L.

*Galium Aparine* L. Cleavers. Fence rows and shady grounds. O. S. April, May. *M.*

*G. virgatum* Nutt. Dry ground in the cedar glades at Laverne. Knoxville. A. Ruth. April-June.

*G. Parisiense* L. *G. anglicum* Huds. Knoxville. A. Ruth.

Along north fork of Holston River, S. W. Va. J. K. Small. June-August.

*G. pilosum* Ait. Hairy bedstraw. Common. O. S. June-August.

*G. pilosum puncticulosum* T. & G. Near Lynchburg, S. W. Va. J. K. Small.

*G. lanceolatum* Torr. E. Tenn. S. W. Va. J. K. Small.

*G. circæzans* Michx. Wild liquorice. Dry woods. O. S. May-July.

*G. triflorum* Michx. Fragrant bedstraw. Cedar glades and dry woods. O. S. June.

*G. latifolium* Michx. High mountains of E. Tenn. July, August.

*G. latifolium* var. *hispidulum* Small. Spurs of Iron Mt.

*G. Arkansanum* Gray. Johnsonville, W. Tenn. June, July.

*G. tinctorium* L. Tennessee. Fide Illustrated Flora.

*G. trifidum* L. Swampy meadows. O. S. June-August.

#### CAPRIFOLIACEÆ Vent.

##### SAMBUCUS L.

*Sambucus Canadensis* L. American elder. O. S. June, July.

*S. pubens* L. Mountain elder. Alleghanies. April, May.

##### VIBURNUM L.

*Viburnum alnifolium* Marsh. *V. lantanoides* Michx. Hobble bush. Mts. of E. Tenn. Summit of Thunderhead, Blount County. May, June.

*V. Opulus* L. Cranberry tree. The variety *floridum* only, with all flowers sterile. Frequently planted shrub in gardens. Sometimes found in derelicted places.

*V. acerifolium* L. Maple-leaved arrow wood. Cumberland and Alleghany Mts. May, June.

*V. dentatum* L. Arrow wood. Peak Mt., S. W. Va. J. K. Small.

*V. cassinoides* L. Beersheba Springs, Cumberland Mts. M. B. Howell. May, June.

*V. nudum* L. White rod. Swampy lands in the oak barrens, Cumberland Plateau. May, June.

*V. prunifolium* L. Black haw. Cumberland Mts. E. Tenn. April-June.

*V. rufo-tomentosum* Small. *V. prunifolium* var. *ferugineum* T. & G. Frequent in the vicinity of Nashville. April, May.

##### TRIOSTEUM L.

*Triosteum perfoliatum* L. Horse gentian. Foot of Cum-

berland Mts., at Cowan. Bluffs of Cumberland River. May-July.

*T. angustifolium* L. Parksville, E. Tenn. Knoxville. A. Ruth. May-July.

### SYMPHORICARPUS Juss.

*Symphoricarpus racemosus* Michx. Snowberry. Along Holston River. J. K. Small. June-September.

*S. Symphoricarpus* (L.) Michx. *S. vulgaris* Michx. Coral berry. Indian currant. Abundant in M. Tenn.

### LONICERA L.

*Lonicera dioica* L. *L. glauca* Hill. *L. parviflora* Lam. Glaucous honeysuckle. Cliffs, north of Bristol. J. K. Small. Mts. of E. Tenn.

*L. Sullivantii* Gray. Woodlands. O. S. May, June.

*L. flava* Sims. E. Tenn. April, May.

*L. sempervirens* L. Trumpet honeysuckle. Frequent in the cedar glades of M. Tenn. June, July.

*L. Japonica* Thunb. Japanese honeysuckle. Naturalized from E. Asia. Banks of Cumberland River, above and below Nashville. June-August.

### DIERVILLA Mœnch.

*Diervilla trifida* Mœnch. *D. Diervilla* McM. Cumberland and Alleghany Mts. May, June.

\**D. rivularis* Gattinger. Lula Falls, eight miles south of summit of Lookout Mt. July. Vide Bot. Gazette, July, 1888.

### VALERIANACEÆ Batsch.

#### VALERIANA L.

*Valeriana pauciflora* Michx. American wild valerian. Moist soil. Vide Gray's Synopt. Flora. May, June.

#### VALERIANELLA Poll.

*Valerianella Locusta* (L.) Bettke. *V. olitoria* L. European corn salad. Cultivated and the young plants eaten as salad under the name of "fetticus." March, April.

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\*Branchlets, nearly terate; leaves, subsessile, ovate, or oblong-lanceolate, acuminate, whitish underneath, all parts hirsutely pubescent; cymes, numerous, 3-6 flowered; corolla, slightly bilabiate, the upper three divisions in close contact, middle lobe longest, the lower lobes more spreading; calyx lobes, slender, lance-subulate; flower, larger and brighter than in *susilifolia*; shrub 3 to 5 feet high, near the edge of a stream.

*V. radiata* (L.) Dufr. Lamb's lettuce. Glades and copses. M. Tenn. March, April.

*V. Woodsiana* (T. & G.) Walpers. Moist ground. O. S. March, April.

*V. Woodsiana* var. *umblicata* Gray, and

*V. Woodsiana* var. *patellaria* Gray. Moist places in the barrens. March, April.

#### DIPSACEÆ Lindl.

##### DIPSACUS L.

*Dipsacus sylvestris* Huds. Wild teasel. Waste places. O. S. July-September.

#### CUCURBITACEÆ Bernh. Juss.

##### CUCURBITA L.

*Cucurbita Melopepo* L. Flat squash. Cult.

*C. verrucosa* L. Warty squash. Cult.

*C. maxima* DC. Winter squash. Cult.

*C. ovifera* Gray. Orange gourd squash, including the Hubbard and the var. *medullosa* A. Gray. Vegetable marrow. Cult.

*C. Pepo* and *Melopepo* L. Common and sugar pumpkins. All these varieties are well known to cultivators.

##### LAGENARIA Seringe.

*Lagenaria vulgaris* Seringe. Cururbita *Lagenaria* L. Bottle gourd. Occurs sometimes self-sown. Summers.

##### CITRULLUS Schrad.

*Citrullus vulgaris* Schrad. Watermelon. The citron is a variety with firm flesh, used for preserving.

##### CUCUMIS L.

*Cucumis Melo* L. Mushmelon, cantaloupe. Var. *flexuosus* is the serpent melon; var. *Dudaim*, vegetable pomegranate, also named *C. odoratissimus*, var. *Chito*, size of goose egg, also called "vine peach."

*C. sativus* L. Cucumber. Cultivated in several varieties. Cult.

*C. Anguria* L. Gherkin. Small, spiny, used for pickling. Cult.

##### LUFFA Roem.

*Luffa cylindrica* Roem. and *L. angularis* R. Towel gourds, dishrag. Useful as a bathing sponge. Cult.

**MELOTHRIA L.**

*Melothria pendula* L. Creeping cucumber. Cedar glades and hillsides. O. S. July, August.

**MICRAMPELIS Raf. (Echinocystis T. & G.)**

*Micrampelis lobata* (Michx.) Greene. *Echinocystis lobata* T. & G. Wild balsam apple. Tullahoma. July.

**SICYOS L.**

*Sicyos angulatus* L. Star cucumber. Hedges and thickets and river banks. O. S. June-September.

**TRIANOSPERMUM Roem.**

*Trianospermum Boykinii*. Roem. Banks of Cumberland River above Nashville. Lester F. Ward. August, September.

**CAMPANULACEÆ Juss.****CAMPANULA L.**

*Campanula aparinoides* Pursh. Boggy laurel thickets, in sphagnum, Cumberland Mts. Sewanee. June-August.

*C. divaricata* Michx. Bell flower. Cumberland and Alleghany Mts. June-September.

*C. Americana* L. Tall bellflower. Moist thickets. July-September.

**LEGOUZIA Durand. (Specularia Heist.)**

*Legouzia biflora* (R. & P.) Britton. *Specularia biflora* A. Gray. Pastures around Nashville. Jackson, W. Tenn. S. M. Bain. April-June.

*L. perfoliata* (L.) Britton. *Specularia perfoliata* A. DC. Venus' looking-glass. Waste grounds. O. S. May-September.

**LOBELIA L.**

*Lobelia cardinalis* L. Cardinal flower. Moist soil. O. S. July-September.

*L. syphilitica* L. Great lobelia. Moist soil. O. S. July-October. *M.*

*L. puberula* Michx. Highlands. O. S. August-October.

*L. spicata* Lam. Cedar glades. E. Tenn. June-August.

*L. leptostachys* A. DC. Moist places in the barrens. July, August.

*L. inflata* L. Indian tobacco. Dry, argillaceous soils. O. S. August, September. *M.*

*L. Nuttallii* R. & P. Mountain bogs. Sewanee. July.

\**L. Gattingeri* Gray. Cedar glades of M. Tenn. April, May.

### CICHORIACEÆ Reichenb.

#### CICHORIUM L.

*Cichorium Intybus* L. Chicory. Roadsides. Waste ground. Sparingly O. S. Root substitute of coffee, shoots blanched for salad. June, July. *M.*

*C. Endivia* L. Endive. Cultivated for salad. Cult.

#### ADOPOGON Neck. (Krigia Schreb.)

*Adopogon Virginicum* (L.) Kuntze. *Krigia amplexicaulis* Nutt. Rich woods. O. S. April, May.

*A. Dandelion* (L.) Kuntze. *Krigia Dandelion* Nutt. Moist woodlands. O. S. April.

*A. Carolinianum* Walt. *Krigia Virginica* Willd. Cumberland Mts. Prospect Station, Giles County. June.

*A. montanum* (Nutt.) *Krigia montana* Nutt. High mountains of E. Tenn. Roane Mt. Chickering. July.

#### TRAGOPOGON L.

*Tragopogon pratensis* L. Meadow salsify. Introduced. Waste grounds near Nashville. Scarce. May, June.

*T. porrifolius* L. Salsify. Introduced. Cultivated in truck gardens and running wild. June. Cult.

#### TARAXACUM Hall.

*Taraxacum Taraxacum* (L.) Karst. Dandelion. *Leontodon Taraxacon* L. Fields and waste places. O. S. April-September. *M.*

*T. erythrospermum* Andrz. With the former. In grass plots. Plant looks more delicate than the former. It is nearly as common as the former. Nashville.

#### SONCHUS L.

*Sonchus oleraceus* L. Sow thistle, and

*S. asper* (L.) Allen. Waste grounds. O. S. May-November.

#### LACTUCA L.

*Lactuca Ludoviciana* (Nutt.) DC. Western lettuce. Re-

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\*N. sp.; flowers, 4 to 5 inches long, deep blue; lobes of the calyx, attenuate, subulate, not at all ciliate, obscurely appendaged at base only by a minute callus on each side, in fruit equaling or longer than the mature capsule (not "shorter"), pedicels often praeceolate (next to *Lobelia appendiculata*).

cently introduced in Nashville, and spreading rapidly. June, July.

**L. Scariola** L. Prickly lettuce. Waste places. Nashville, Knoxville. Naturalized from Europe.

**L. sativa** L. Garden lettuce, descending from the former. Cultivated in many varieties.

**L. Canadensis** L. Wild lettuce. Clearings and woodlands. O. S. June. *M.*

**L. villosa** Jacq. *L. acuminata* Gray. Blue lettuce. Thickets. O. S. July-September.

**L. Floridana** (L.) Gært. Rich woods. O. S. July-September.

**L. spicata** (Lam.) Hitchc. *L. leucophæa* A. Gray. River bottoms. O. S. June-September.

**L. spicata integrifolia** A. Gray. Highlands. June, July.

**L. hirsuta** Mühl. Knoxville. L. T. Scribner.

#### **NOTHOCALAIS** Greene. (*Troximon* Nutt.)

**Nothocalais cuspidata** (Pursh.) Greene. Knoxville. Ruth. *Troximon cuspidatum* Nutt.

#### **SITILIAS** Raf. (*Pyrrhopappus* DC.)

**Sitilias Caroliniana** (Walt.) Raf. *Pyrrhopappus Carolinianus* DC. East of Cleveland. Ducktown Road. April-July.

#### **HIERACIUM** L.

**Hieracium venosum** L. Rattlesnake weed. Dry woods. O. S. May-October.

**H. Marianum** Willd. Maryland hawk weed. Farmer Mt., S. W. Va. J. K. Small. May-July.

**H. paniculatum** L. Dry woodlands. O. S. July-September.

**H. scabrum** Michx. Dry woods. O. S. June-September.

**H. longipilum** Torr. W. Tenn. July.

**H. Gronovii** L. Dry soil. Nashville. June, July.

**H. Scribneri** Small. Lookout Mt. Legit F. L. Scribner. Is perhaps *H. Greenii*.

#### **NABALUS** Cass. (*Prenanthes* L.)

**Nabalus altissimus** Hook. *Prenanthes altissimus* L. Highlands. July-September.

**N. albus** Hook. *P. alba* L. Rattlesnake root. Jackson, W. Tenn. S. M. Bain. July. *M.*

**N. serpentarius** (Pursh.) Hook. *P. serpentaria* Pursh. Lion's foot. Barrens of Dickson County. August. *M.*

*N. serpentarius* var. *barbatus* Gray. Roane Mt. Chickering. Big Thunderhead. July, August.

*N. asper* (Michx.) T. & G. Barrens. O. S. July, August.

*N. crepidineus* (Michx.) DC. Bottoms. O. S. August.

#### AMBROSIACEÆ Reichb.

##### AMBROSIA L.

*Ambrosia bidentata* Micx. Waste grounds at Brownsville, W. Tenn. August.

*A. trifida* L. Horse weed. Along water courses. O. S.

*A. trifida integrifolia* T. & G. With the former.

*A. artemisiæfolia* L. Rag weed. The most abundant weed in the State. August.

*A. psilostachya* DC. Knoxville. A. Ruth. July-October.

##### XANTHIUM L.

*Xanthium spinosum* L. Burr weed. In towns, along railroad tracks. O. S. September. *O.*

*X. Canadense* Mill. American cocklebur. O. S. July-October.

*X. strumaricum* L. Waste places. With the former. July-September.

#### COMPOSITÆ Adans.

##### VERNONIA Schreb.

*Vernonia noveboracensis* (L.) Willd. Iron weed. Dry soil. O. S. July-October.

*V. Baldwinii* Torr. W. Tenn. August.

*V. gigantea* (Walt.) Britton. *V. altissima* Nutt. Tall iron weed. Moist soil. O. S.

*V. fasciculata* Michx. With the former. O. S. July-September. *M.*

##### ELEPHANTOPUS L.

*Elephantopus Carolinianus* Willd. Elephant's foot. Dry woods. M. Tenn. August-September. *M.*

*E. tomentosus* L. Cumberland and Alleghany Mts. August-September. *M.*

##### EUPATORIUM L.

*Eupatorium capillifolium* (Lam.) Smal. *E. fœniculaceum* Willd. Dog fennel. Lawrenceburg. E. Tenn.

*E. purpureum* L. Gravel root. Moist soils. O. S. August, September. *M.*

*E. serotinum* Michx. Thoroughwort. Streets of Nashville. O. S. September-November.

*E. album* L. Paradise Ridge. Robertson County. E. Tenn. August, September.

*E. hyssopifolium* L. Knoxville. F. L. Scribner. August, September.

*E. semiserratum* DC. Barrens at Tullahoma. Knoxville. August, September.

*E. altissimum* L. Dry copses around Nashville. August-October.

*E. verbenæfolium* Michx. *E. tencrifolium* Michx. Hampton, E. Tenn. A. Ruth.

*E. rotundifolium* L. Mitchellville. Tullahoma. July, August.

*E. pubescens* Mühl. *E. rotundifolium* var. *ovatum* Torr. Cumberland Gap. J. K. Small. July-September.

*E. perfoliatum* L. Boneset. Low grounds. O. S. July-September. *M.*

*E. sessilifolium* L. E. Tenn. A. Ruth. Middle fork of Holston River. J. K. Small. July, August.

*E. ageratoides* L. White snake root. O. S. *M.*

*E. aromaticum* L. Barrens of Tullahoma. Knoxville. A. Ruth. August-October.

*E. coelestinum* L. *Conoclinium coelestinum* DC. Mist flower. Moist soil. Edge of ponds. O. S. August-October.

#### KUHNIA L.

*Kuhnia eupatorioides* L. False boneset. O. S. August-October.

*K. glutinosa* Ell. *K. eupatorioides* var. *corymbulosa* T. & G. Glades around Nashville. September, October.

#### LACINIARIA Hill. (*Liatris* Schreb.)

*Laciniaria squarrosa* (L.) Hill. *Liatris squarrosa* Willd. Scaly blazing star. Greenbrier, Robertson County. June, July. *M.*

*L. scariosa squarrosa* Small. Mts. of E. Tenn. July. *M.*

*L. spicata* L. Kuntze. *Liatris spicata* Willd. Botton snake root. M. and E. Tenn. July. *M.*

*L. graminifolia* (Pursh.) Barrens of M. Tenn. and mountains of E. Tenn. July, August.

*L. microcephala* J. K. Small. Tullahoma. With the former. Vide Bull. Torr. Bot. Club., September, 1898.

#### GRINDELIA Willd.

*Grindelia lanceolata* Nutt. Cedar glades of Lavergne. July-September. *M.*

## CHRYSOPSIS Nutt.

*Chrysopsis graminifolia* (Michx.) Nutt. Golden aster. Cumberland and Alleghany Mts.

*Ch. Mariana* (L.) Nutt. Sandy soil. O. S. June, July.

*Ch. Ruthii* Small. Hiwassee Valley. A. Ruth.

## SOLIDAGO L.

*Solidago cæsia* L. Blue-stemmed golden-rod. O. S. September.

*S. cæsia* var. *paniculata* Gray. With the former.

*S. flexicaulis* L. *S. latifolia* L. Cliffs on Richland Creek, near Nashville. Highlands. August, September.

*S. Curtisii* T. & G. Roane Mt. J. W. Chickering. July.

*S. bicolor* L. White golden-rod. Dry soil. August, September.

*S. hispida* Mühl. *S. bicolor* var. *concolor* T. & G. Siliceous soils. O. S. July, August.

*S. erecta* Pursh. *S. speciosa* var. *angustata*. Greenbrier. Glades at Lavergne. August.

*S. monticola* T. & G. Clingman Dome of the Smokies. Roane Mt. Chickering. July.

*S. puberula* Nutt. Knoxville. A. Ruth.

*S. speciosa* Nutt. Highlands of M. Tenn. Greenbrier. August-October.

*S. odora* Ait. Barrens and highlands. O. S. July. *M.*

*S. rugosa* Willd. Along Mill Creek, Nashville. Highlands. July-October.

*S. ulmifolia* Mühl. With the former. July.

*S. Boottii* Hook. Smoky Mts. July.

*S. juncea* Ait. Oak barrens and woodlands. M. Tenn. July.

*S. arguta* Ait. Lookout Mt. Ocoee region. August, September.

*S. rupestris* Raf. Cliffs along Cumberland River. July, August.

*S. serotina* Ait. *S. gigantea* Willd. Fields and fence rows. O. S. September, October.

*S. serotina* var. *gigantea* Gray. With the former.

\**S. Gattingeri* Chapm. Cedar glades at Lavergne. Abundant around Tullahoma. August, September.

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\**Solidago Gattingeri* Chapm. Slender, upright, 2 to 4 feet high; branches and inflorescence, perfectly smooth and glabrous; leaves, ciliolate; lower cauline and radical lanceolate-spatulate, appressed serrulate, obviously tripli-nerved; upper cauline mainly entire and without lateral ribs, oblong lanceolate and an inch or so long, and the upper reduced to half or quarter inch, but near the inflorescence very small and bractlike; racemiform clusters of small heads open and

*S. Canadensis* L. O. S. Abundant. September, October.

*S. Canadensis procera* T. & G. With the former.

*S. Canadensis scabriuscula* T. & G. Low, wet ground. Nashville. October.

*S. rigida* L. Knoxville. A. Ruth.

*S. corymbosa* Ell. Bon Aqua, Dickson County. Tullahoma. July, August.

*S. mollis* Bart. *S. nemoralis* A. Gray. Abundant in all glades and barrens. July-September.

*S. spithamea* M. A. Curtis. Roane Mt. J. W. Chickering. July.

*S. stricta* Ait. Knoxville. A. Ruth.

### EUTHAMIA Nutt.

*Euthamia graminifolia* (L.) Nutt. *Solidago lanceolata* L. Fragrant golden-rod. Fountain Head, Robertson County. July.

### BRACHYCHÆTA T. & G.

*Brachychæta sphacelata* Raf. *B. cordata* Gray. O. S. September, October.

### BELLIS L.

*Bellis integrifolia* Michx. Western daisy. Copses. O. S. April, May.

### BOLTONIA L'Her.

*Boltonia diffusa* Ell. Damp, sandy soil. Tullahoma. Paradise Ridge. August-October.

### SERICOCARPUS Nees.

*Sericocarpus linifolius* (L.) B. S. P. *S. solidagineus* Nees. Dry, argillaceous soils. O. S. June-September.

*S. asteroides* (L.) B. S. P. *S. conyzoides* Nees. With the former. June-September.

### ASTER L.

*Aster divaricatus* L. *A. corybosus* Ait. White wood aster. Mountain districts. Sewanee. July.

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spreading, not recurving, disposed to forming a corymbiform very naked panicle; involucrel bracts, oblong, very obtuse, yellowish in the dried plant; flowers, 15-20 in the head; rays, 4-6; akenes, appressed-puberulent or the lower part glabrous. (*S. Missouriensis*, var. *pumila* Chapm. Fl. Suppl., 627.) Between *Missouriensis* and *Shortii* Gray. It occurs in numerous individuals over a couple of acres, and is not likely to be a hybrid. The associated species are *S. nemorosa* (very abundant), *S. speciosa*, var. *angustata*, *S. speciosa*, *S. Canadensis*. First collected, September, 1869.

- A. macrophyllus* L. Marion, S. W. Va. J. K. Small.  
*A. azureus* Lindl. Knoxville. A. Ruth. August-October.  
*A. cordifolius* L. Rocky glens. O. S. September.  
*A. sagittæfolius* Willd. Wild goose pond near Mitchellville. September.  
*A. undulatus* L. O. S. September.  
*A. patens* Ait. Highlands. September.  
*A. phlogifolius* Mühl. With the former. September.  
*A. oblongifolius* Nutt. Cliffs on Cumberland River near Nashville. September.  
*A. Drummondii* Lindl. Nashville. September.  
*A. lævis* L. Nashville. September.  
*A. concolor* L. Oak barrens of M. Tenn. July-September.  
*A. Shortii* Hook. Rich woodlands. M. Tenn. August, September.  
*A. gracilis* Nutt. Tuberos-rooted aster. Blount County. A. Ruth.  
*A. surculosus* Michx. Creeping aster. E. Tenn. A. Ruth. September, October.  
*A. puniceus* L. Vicinity of Nashville. Knoxville. A. Ruth.  
*A. paludosus* Ait. Moist ground in the barrens. August-October.  
*A. Curtisii* Torr & Gray. Roane Mt. J. W. Chickering. July.  
*A. dumosus* L. Sandy soil, covering acres of ground. August, September.  
*A. Tradescanti* L. Sandy soil. As abundant as the former. August, September.  
*A. multiflorus* Ait. Old fields. Siliceous soils. Abundant. August-November.  
*A. acuminatus* Michx. Roane Mt. A. Ruth.  
*A. lateriflorus* (L.) Britton. *A. diffusus* Ait. *A. miser* Nutt. In dry or damp soil. O. S. Very variable. August-October.  
*A. lateriflorus thyrsoides*. A. Gray. River banks.  
*A. lateriflorus grandis* Port. *A. diffusus* var. *bifrons*. Gray. Moist, shady places.  
*A. lateriflorus horizontalis* (Desf.) Burgess. Thickets along Cumberland River. September, October.  
*A. ericoides* L. Frost weed. Covering large tracts in calcareous soils. O. S. September, October.  
*A. ericoides pilosus* (Willd.) Porter. *A. villosus* Michx. With the former.  
*A. ericoides* var. *Rivesii* A. Gray. Dry river banks near Nashville and cedar glades in M. Tenn. September, October.

## ERIGERON L.

*Erigeron pulchellus* Michx. *E. bellidifolius* Mühl. Robin's plantain. Siliceous or argillaceous soils. O. S. April, May.

*E. Philadelphicus* L. Philadelphia fleabane. Troublesome weed in meadows. April-June. *M.*

*E. annuus* (L.) Pers. Sweet scabious. Dry glades. O. S. May, June.

*E. ramosus* (Walt.) B. S. P. Daisy fleabane. *E. Strigosus* Michl. Fields and pastures. O. S.

*E. ramosus Beyrichii* Smith & Pamel. W. Tenn.

## LEPTILON Raf.

*Leptilon Canadense* (L.) Britton. *Erigeron Canadense* L. Canada fleabane. Some plants reach 10 feet high; some are minute, only 1 inch high. O. S. June-November. *M.*

*L. divaricatum* (Michx.) Raf. *Erigeron divaricatus* Michx. Sandy soil. M. Tenn. June-October.

## DÖELLINGERIA Nees.

*Dœllingeria umbellata* (Mill.) Nees. *Diplopappus umbellatus* Hook. O. S. July.

*D. infirma* (Michx.) Greene. *Diplopappus cornifolius* Less. Cumberland and Alleghany Mts. August, September. Roane Mt. A. Ruth. July.

## IONACTIS Greene.

*Ionactis linariifolius* (L.) Greene. Dry, siliceous, or argillaceous soils. O. S. July.

## PLUCHEA Cass.

*Pluchea foetida* L. Marsh. Fleabane. Swampy ground. O. S. July-September.

## ANTENNARIA Gært.

*Antennaria plantaginifolia* L. Richards. Everlasting. Dry woods. O. S. April.

*A. monocephala* Kearney. Knoxville. A. Ruth.

## GNAPHALIUM L.

*Gnaphalium obtusifolium* L. *G. polycephalum* Michx. Sweet everlasting. Dry, open places. O. S. August, September. *M.*

*G. Helleri* Britt. Wolf Creek, Cocke County. September.

*G. decurrens* Ives. Clammy everlasting. Highlands. June-August.

*G. uliginosum* L. Bogs on Cumberland Mts. July-September.

*G. purpureum* L. Sandy soils. O. S. May-September.

### INULA L.

*Inula Helenium* L. Elecampane. Naturalized from Europe. Sweetwater, Loudon County, E. Tenn. July. *M.*

### POLYMNIA L.

*Polymnia Uvedalia* L. Leaf cup. Yellow bear's foot. O. S. July, August. *M.*

*P. Canadensis* L. Ravines in the Cumberland and Alleghany Mts. June-September.

*P. Canadensis radiata* A. Gray. With large three-dentate, shining white ligules. Plant not over 2 feet high. Ought to rank as a species. Fosterville, in the cedar glades. June, July.

### SILPHIUM L.

*Silphium perfoliatum* L. Cup plant. Brown's Creek, near Nashville. July-September. *M.*

*S. integrifolium* Michx. Rosin weed. Charlotte Pike, near Nashville. July.

*S. trifoliatum* L. Whorled rosin weed. O. S. July, August.

*S. Asteriscus* L. Craggie Hope. Cheatham County. Paradise Ridge. Knoxville.

*S. Asteriscus* var. *laevicaulis* DC. Tulahoma. June, July.

*S. laciniatum* L. Compass plant. E. Tenn. July-September. *M.*

\**S. brachiatum* Gattinger. Foot of mountains at Cowan.

*S. scaberrimum* Ell. Barrens at Tullahoma. July.

*S. terebinthinaceum* Jacq. Prairie dock. Lavergne. June, July.

*S. terebinthinaceum* var. *pinnatifidum* Gray. Same range.

*S. compositum* Michx. Western slopes of Chilhowee Mts. and in the hills on Chestua Creek. E. Tenn. July, August.

*S. rumicifolium* J. K. Small. Knoxville. Prof. Ruth. July-September.

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\**S. brachiatum* Gattinger. Stem, 3 to 5 feet high and very slender; brachiate branches, smooth, glabrous, glaucous; leaves, somewhat hispidulous-scabrous, thin; cauline, hastate or deltoid-lanceolate, 4 to 8 lines long, slightly dentate on rarely long and barely margined or naked petioles; those of the branches, small and very distant, sessile, ovate-lanceolate, entire; uppermost reduced to small bracts, heads small, half inch or so high, on long and slender peduncles; involucrel bracts, ovate; rays, 6-8; akenes, ovate-orbicular, narrowly winged, with barely emarginate summit. (Bot. Gazette, IX., 192; coll., 1867.)

**CHRYSOGONUM L.**

*Chrysogonum Virginianum* L. Ducktown, Polk County. April-July.

**PARTHENIUM L.**

*Parthenium integrifolium* L. American fever few. Dry grounds. O. S. July.

**HELIOPSIS L.**

*Heliopsis helianthoides* (L.) B. S. P. *H. lævis* Pers. Ox eye. Highlands of M. Tenn. and mountains of E. Tenn. August, September.

*H. scabra* Dunal. Paradise Ridge. Knoxville. July.

**ZINNIA L.**

*Zinnia pauciflora* L. Escaped. Nashville.

**ECLIPTA L.**

*Eclipta alba* (L.) Hassk. *E. procumbens* Michx. Moist ground, along streams, and a weed in fields and gardens. Naturalized from tropical America: July-October.

**TETRAGONOTHECA L.**

*Tetragonotheca helianthoides* L. Cave Spring, Roane County.

**RUDBECKIA L.**

*Rudbeckia triloba* L. Cone flower. O. S. July-September.

*R. subtomentosa* Pursh. Henderson, W. Tenn. S. M. Bain.

*R. hirta* L. Black-eyed Susan. Barrens. O. S. August, September.

*R. Brittoni* Small. Mts. of E. Tenn. Fide Illustrated Flora. May-July.

*R. fulgida* Ait. Dry woods and barrens. O. S. August-October.

*R. spathulata* Michx. Chilhowee Mts., E. Tenn. A. H. Curtiss. September.

*R. speciosa* Wenderoth. Lavergne. Hollow Rock. August-October.

*R. laciniata* L. Paradise Ridge. Mts. of E. Tenn. Wolf Creek. Var. *humilis* Gray. Is a mountain form. July-September. *M.*

*R. bicolor* Nutt. Open, dry barrens. Nashville. Bon Air. September.

\**R. umbrosa* n. sp. C. L. Boynton and C. D. Beadle.  
Sparta, White County. August.

### RATIBIDA Raf. (Lepachys Raf.)

*Ratibida pinnata* (Vent.) Bernhart. *Lepachys pinnata*  
Torr & Gray. Dry copses. O. S. June-September.

*R. columnaris* (Sims) D. Don. Prairie cone flower, var *pulcherrima*. Found near cotton compress, S. Nashville. A waif.

### BRAUNERIA Neck. (Echinacea Mœnch.)

*Brauneria purpurea* L. Britton. *Echinacea Mœnch*.  
Black Sampson. M. and E. Tenn. In moist, rich soil.

*B. pallida* (Nutt.) Britton. *Echinacea angustifolia* Nutt.  
Hills near Nashville. Flowers differ from deep purple to pure white. July-October.

### HELIANTHUS L.

*Helianthus angustifolius* L. Swamp sunflower. Craggy  
Hope, Cheatham County, and in W. Tenn. S. M. Bain.

*H. annuus* L. Common sunflower. Frequently escaping  
cultivation. July-September.

*H. verticillatus* Small. Henderson, W. Tenn. S. M. Bain.

*H. atrorubens* Nutt. Dry woods. O. S. August-October.

*H. lævigatus* Torr & Gray. Mts. of E. Tenn. August-October.

*H. microcephalus* T. & G. *H. parviflorus* Bernh. O. S.  
July-August.

*H. giganteus* L. Knoxville. A. Ruth. August-October.

*H. divaricatus* L. Highlands of M. Tenn. E. Tenn. July,  
August.

*H. mollis* Lam. Barrens of M. Tenn. Abundant. August,  
September.

*H. decapetalus* L. Highlands of M. Tenn. Mts. of E.  
Tenn. August, September.

*H. trachelifolius* Michx. Big Frog Mts., Polk County.  
July, August.

*H. hirsutus* Raf. Barrens of M. Tenn. Abundant. July,  
August.

*H. lætiflorus* Pers. Brownsville, W. Tenn. August, Sep-  
tember.

*H. tomentosus* Michx. Lake Otase, near\* Knoxville. A.  
Ruth.

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\**R. umbrosa* C. L. Boynton. Related to *R. speciosa* Wender., differing from the latter species in the broad and hairy-lipped chaff, size of flower heads, shorter and fewer rays, and in the outline of the leaves. (Biltmore Botanical Studies, Vol. I., No. 1.)

**H. tuberosus** L. Jerusalem artichoke. Rich soil. River banks. Also sometimes in cultivation. Deserves more attention as a foodstuff for hogs. Hard to eradicate from fields where it once has been planted. September, October.

### VERBESINA L. (Actinomeris Nutt.)

**Verbesina Virginica** L. Virginia crownbeard. Limestone soils. M. Tenn. August, September.

**V. occidentalis** (L.) Walt. Western declivities of Smoky Mts. In abundance. September.

**V. helianthoides** Michx. Actinomeris helianthoides Nutt. Moist woods. O. S. June, July.

**V. alternifolia** (L.) Britton. Actinomeris squarrosa Nutt. Moist woods. O. S. August, September.

### HELIANTHELLA T. & G.

**Helianthella tenuifolia** T. & G. In big patches, two miles east of Tulahoma. July.

### COREOPSIS L.

**Coreopsis rosea** Nutt. In a swamp in Ducktown, Polk County. July.

**C. tinctoria** Nutt. Garden tick seed. Frequently escaping cultivation. July, September.

**C. major** Walt. *C. senifolia* Michx. Siliceous soils. O. S. July, August.

**C. major Oemleri** (Ell.) Britton. *C. senifolia* var. *stellata* T. & G. With the former. July, August.

**C. delphinifolia** Lam. E. Tenn. June-September.

**C. verticillata** L. Upper E. Tenn. June-September.

**C. pubescens** Ell. Cumberland Mts. June-August.

**C. crassifolia** Ait. *C. lanceolata* var. *villosa* Michx. Banks of Cumberland River at Nashville. May-September.

**C. auriculata** L. Greenbrier, Robertson County. June.

**C. grandiflora** Nutt. Harpeth hills, south of Nashville. July-September.

**C. tripteris** L. Common tick seed. Low lands and thickets. O. S. August, September.

### BIDENS L.

**Bidens lævis** (L.) B. S. P. *B. chrysanthemoides* Michx. Smooth marigold. Wet lands and ditches. O. S. August-November.

**B. cernua** L. Nodding burr marigold. In water and wet lands. O. S. July-October.

*B. connata* Mühl. Swamp beggar ticks. Swamps and ditches. O. S. August-October.

*B. discoidea* (T. & G.) Britton. River swamps. O. S. August, September.

*B. frondosa* L. Beggar ticks. Moist soil. O. S. July-October.

*B. bipinnata* L. Spanish needles. Bad weed. O. S. July-October.

*B. trichosperma* (Michx.) Britton. *Coreopsis trichosperma* Michx. Tick-seed sunflower. River swamps. Nashville. August, September.

*B. aristosa* (Michx.) Britton. Var. *mutica* A. Gray. Jackson, W. Tenn. S. M. Bain.

### GALINSOGA R. & P.

*Galinsoga parviflora* Cav. Introduced from S. America. Gardens near Nashville. September.

### MARSHALLIA Schreb.

*Marshallia trinervia* (Walt.) Porter. *M. latifolia* Pursh. Fountain Head. Eggert. Tullahoma. May, June.

*M. lanceolata* Pursh. Vicinity of Memphis. Dr. G. Ege-ling. May, June.

### HELIENIUM L.

*Helenium autumnale* L. Sneezeweed. River banks and low grounds. O. S. August-October.

*H. nudiflorum* Nutt. *Leptopoda brachypoda* T. & G. Sandy, damp soils. O. S. Tullahoma. July, August.

*H. tenuifolium* Nutt. Scattering. O. S. August-October.

*H. parviflorum* Nutt. Cedar glades at Lavergne. July-September.

### DYSODIA Cav.

*Dysodia papposa* (Vent.) A. S. Hitchcock. Fetid marigold. *D. chrysanthemoides* Lag. Mitchellville. Abundant across State line in Kentucky. July-October.

### ACHILLEA L.

*Achillea Millefolium* L. Millfoil. Yarrow. Roadsides and pastures. O. S. June-November.

### ANTHEMIS L.

*Anthemis Cotula* L. May weed. Fetid chamomile. Waste ground. O. S. May, June.

**CHRYSANTHEMUM L.**

*Chrysanthemum Leucanthemum* L. Ox-eye daisy. O. S. May-July.

**MATRICARIA L.**

*Matricaria Chamomilla* L. German chamomile. Formerly cultivated by early settlers as a medicinal herb, and now occasionally in fields. June, July.

**TANACETUM L.**

*Tanacetum vulgare* L. Tansy. Cultivated and in waste grounds. July, August.

**ARTEMISIA L.**

*Artemisia Absinthium* L. Common wormwood. Rarely on waste grounds near gardens. Adventive from Europe, and frequently in gardens. July, September.

*A. annua* L. Adventive from Asia, but widely disseminated and abundant near Nashville. September, October.

*A. biennis* Willd. W. Tenn. Copiously on the banks of the Ohio River at Louisville. September, October.

*A. Mexicana* Willd. W. Nashville, on open grounds. September, October.

**ERECHTITES Raf.**

*Erechtites hieracifolia* R. In clearings. O. S. June, July.

**MESADENIA Raf. (Cacalia Nutt.)**

*Mesadenia reniformis* (Mühl.) Raf. *Cacalia reniformis* Mühl. Great Indian plantain. Cumberland and Alleghany Mts. July, August.

*M. atriplicifolia* (L.) Raf. Rich woodlands. O. S. July.

*M. tuberosa* (Nutt.) Britton. Wet places in the cedar glades. July, August.

**SYNOSMA Raf.**

*Synosma suaveolens* (L.) Raf. *Cacalia suaveolens* L. Banks of Turnbull Creek, near Kingston Springs. July, August.

**SENECIO L.**

*Senecio obovatus* Mühl. Squaw weed. *S. Aurens* var. *obovatus* T. & G. Moist soil. M. Tenn. April-June.

*S. Balsamitæ* Mühl. *S. aurens* var. *Balsamitæ* T. & G. Ducktown. E. Tenn. May-July.

*S. Smallii* Britt. Banks of Wolf Creek. E. Tenn.

*S. aureus* L. Golden ragwort. Swamps and wet meadows. O. S. May-July.

*S. lobatus* Pers. Butter weed. Wet places. Brownsville. Lavergne. April, May.

*S. vulgaris* L. Knoxville. Erratic.

*S. Rugelia* Gray. Smoky Mts. Legit Dr. Rugel.

*S. Earlei* J. K. Small. Knoxville. Professor Ruth. May-July.

#### ARCTIUM L.

*Arctium Lappa* L. Burdock. Waste grounds. O. S. July, August.

*A. minus* Schk. Cumberland Gap. J. K. Small.

#### CARDUUS L.

*Carduus lanceolatus* L. *Crisium lanceolatum* Scop. Common thistle. O. S. July, August.

*C. altissimus* L. *Cnicus altissimus* Willd. Fence rows. O. S. Not as frequent as the former. July-November.

*C. discolor* (Mühl.) Nutt. *Cnicus altissimus* var. *discolor*. A. Gray. Banks of Cumberland River below Nashville. July-November.

*C. muticus* (Michx.) Pers. Lookout Mt. Roane Mt. Chickering. July.

#### MARIANA Hill. (*Silybum* Gært.)

*Mariana Mariana* (L.) Hill. *Silybum Marianum* Gært. Milk thistle. Near Tracy City. Mrs. Turner. Nashville, near Chattanooga shops. June-August.

#### ONOPORDON L.

*Onopordon Acanthium* L. Cotton thistle. Dry pastures and roadsides around Nashville. July-September.

#### CENTAUREA L.

*Centaurea Cyanus* L. Blue bottle. Corn flower. Waste places. Escaped from cultivation.

#### CNICUS L.

*Cnicus benedictus* L. Blessed thistle. *Centaurea benedicta* L. Waste ground around Livingston Hall, Nashville. Mrs. Lydia Bennett. May-August.

## ADDENDA TO SYNOPSIS OF THE FLORA OF TENNESSEE.

*Cratægus apiifolia* Michx. Collected by T. G. Harbison at Memphis.

\**Juncoides bulbosum* Wood. Lookout Mt. S. M. Bain.

*Rudbeckia monticola* J. K. Small. White Cliff Springs. T. H. Kearney. Lookout Mt. H. Eggert.

‡*Cornus Priceæ* J. K. Small. Bluffs on Cumberland River at Nashville.

\**Juncoides bulbosum* Wood. Base of plant accompanied by bulbets; foliage, almost glabrous, or somewhat webby on the leaf margins and at the top of the sheaths; stems, 1-4 dm. tall; spikes, shorter than those of *J. echinatum*; sepals and petals, ovate-lanceolate or lanceolate, 2-2.5 mm. long, brownish, acuminate, neither manifestly soft nor hyaline at the apex; capsule, broadly obovoid or globose-obovoid, surpassing the sepals or sometimes about equaling them.

†*Cornus Priceæ*. A branching shrub 1-2.5 m. tall, with red and finely-pubescent twigs; leaves, numerous; blades, elliptic to ovate-elliptic or ovate, 5-12 cm. long, rather leathery, usually acuminate, deep green and roughly pubescent above, pale and more copiously, but rather softly pubescent and prominently veined beneath; petioles, 1-2 cm. long, pubescent like the twigs; corymbs, 2-3 cm. broad during anthesis, 4-6 cm. broad at maturity; peduncles and pedicels, closely and harshly pubescent; sepals, triangular; corolla, white, about 7 mm. broad; petals, 4, oblong-lanceolate to linear-lanceolate; filaments, slightly shorter than the petals; drupes, about 3 mm. in diameter, subglobose, white; stone, about 2 mm. in diameter, scarcely longer than broad, faintly pitted.

LIST OF ORDERS—With the Number of Genera and Species, the Cultivated and Official.

	Genera.	Species.	Cultivated.	Official.		Genera.	Species.	Cultivated.	Official.
<b>Pteridophyta</b>					<b>Dicotyledones—Contin'd</b>				
Ophioglossaceæ.....	2	4	.....	1	Loranthaceæ.....	1	1	.....	1
Osmundaceæ.....	1	3	.....	.....	Santalaceæ.....	3	3	.....	.....
Hymenophyllaceæ.....	1	1	.....	.....	Aristolochiaceæ.....	2	2	.....	.....
Schizaceæ.....	1	1	.....	.....	Polygonaceæ.....	5	28	12	.....
Polypodiaceæ.....	15	41	.....	5	Chenopodiaceæ.....	3	13	.....	.....
Salviniaceæ.....	1	1	.....	.....	Amaranthaceæ.....	4	7	1	.....
Equisetaceæ.....	1	3	.....	.....	Phytolaccaceæ.....	1	1	.....	1
Lycopodiaceæ.....	2	6	.....	1	Nyctaginaceæ.....	1	2	.....	.....
Isoetaceæ.....	1	1	.....	.....	Aizoaceæ.....	1	1	.....	.....
<b>Spermatophyta.</b>					Portulacaceæ.....				
<b>Gymnospermae.</b>					Caryophyllaceæ.....				
Pinaceæ.....	7	14	.....	3	Nymphaeaceæ.....	6	6	.....	2
Taxaceæ.....	1	1	.....	.....	Magnoliaceæ.....	2	7	.....	6
<b>Angiospermae.</b>					Anonaceæ.....				
<b>Monocotyledones.</b>					Ranunculaceæ.....				
Typhaceæ.....	1	2	.....	.....	Berberidaceæ.....	5	6	.....	3
Sparganiaceæ.....	1	2	.....	.....	Menispermaceæ.....	3	3	.....	1
Naiadaceæ.....	2	8	.....	.....	Calceanthaceæ.....	1	2	.....	2
Alismaceæ.....	3	6	.....	1	Lauraceæ.....	3	4	.....	2
Valisneriaceæ.....	1	1	.....	.....	Papaveraceæ.....	9	15	.....	2
<b>Gramineae.</b>					Cruciferae.....				
Mayideæ.....	2	2	.....	.....	Capparidaceæ.....	2	2	.....	.....
Andropogonaceæ.....	1	16	3	.....	Saraceniaceæ.....	1	1	.....	1
Panicereæ.....	9	59	.....	.....	Podostemaceæ.....	1	2	.....	.....
Orycereæ.....	3	5	.....	.....	Crassulaceæ.....	3	9	.....	1
Phalaridaceæ.....	2	4	.....	.....	Saxifragaceæ.....	12	27	.....	2
Agrostidaceæ.....	10	35	.....	.....	Grosulariaceæ.....	1	7	.....	2
Avenaceæ.....	6	9	.....	.....	Hamamelidaceæ.....	2	2	.....	2
Chloridaceæ.....	7	7	.....	.....	Platanaceæ.....	1	1	.....	.....
Festuceæ.....	14	54	.....	.....	Rosaceæ.....	20	83	3	9
Hordeaceæ.....	7	31	.....	.....	Drupaceæ.....	2	14	5	1
Bambuseæ.....	1	2	.....	.....	Mimosaceæ.....	3	5	.....	.....
Cyperaceæ.....	13	124	.....	.....	Caesalpiniaceæ.....	4	9	.....	.....
Araceæ.....	5	6	.....	4	Papilionaceæ.....	30	103	5	12
Lemnaceæ.....	3	7	.....	.....	Geraniaceæ.....	1	3	.....	2
Xridaceæ.....	1	2	.....	.....	Oxalidaceæ.....	1	8	.....	1
Eriocaulonaceæ.....	2	7	.....	.....	Linaceæ.....	1	5	.....	2
Pontederiaceæ.....	2	4	.....	1	Rutaceæ.....	3	3	.....	.....
Juncaceæ.....	2	17	.....	1	Simarubaceæ.....	1	1	.....	1
Melanthaceæ.....	8	14	.....	1	Meliaceæ.....	2	2	.....	1
Jilliceæ.....	11	13	6	4	Polygalaceæ.....	1	11	.....	1
Convallariaceæ.....	10	22	1	3	Euphorbiaceæ.....	8	251	.....	3
Smilacaceæ.....	1	11	.....	3	Callitrichaceæ.....	1	1	.....	.....
Amaryllidaceæ.....	3	3	.....	1	Buxaceæ.....	1	1	.....	.....
Dioscoreaceæ.....	1	2	.....	1	Anacardiaceæ.....	2	8	.....	4
Iridaceæ.....	4	11	.....	1	Ilicineæ.....	1	8	.....	2
Orchidaceæ.....	14	40	.....	4	Celastraceæ.....	2	3	.....	2
<b>Dicotyledones.</b>					Staphyleaceæ.....				
Saururaceæ.....	1	1	.....	1	Aceraceæ.....	1	1	.....	1
Juglandaceæ.....	2	11	.....	5	Hippocastanaceæ.....	1	6	.....	1
Salicineaæ.....	2	17	2	3	Sapindaceæ.....	1	1	.....	1
Betulaceæ.....	5	10	.....	1	Rhamnaceæ.....	1	2	.....	.....
Fagaceæ.....	3	21	.....	7	Balsaminaceæ.....	4	5	1	1
Ulmaceæ.....	3	8	.....	1	Vitaceæ.....	3	11	.....	1
Moraceæ.....	5	61	.....	4	Tiliaceæ.....	1	3	1	3
Urticaceæ.....	5	9	.....	1	Malvaceæ.....	7	172	.....	2
					Theaceæ.....				
					Hypericaceæ.....				
					Cistaceæ.....				
					Violaceæ.....				
					Passifloraceæ.....				
					Cactaceæ.....				
					Thymelaeaceæ.....				
					Lythraceæ.....				

LIST OF ORDERS — Continued.

	Genera.	Species.	Cultivated.	Official.		Genera.	Species.	Cultivated.	Official.
<b>Dicotyledones—Contin'd</b>					<b>Dicotyledones—Contin'd</b>				
Melastomaceæ.....	3	4	.....	.....	Cuscutaceæ.....	1	9	.....	.....
Ouagraceæ.....	11	25	.....	1	Polemoniaceæ.....	7	26	.....	1
Halloragidaceæ.....	2	4	.....	.....	Boraginaceæ.....	10	22	.....	5
Araliaceæ.....	2	5	.....	5	Verbenaceæ.....	3	10	.....	5
Umbelliferae.....	30	52	12	8	Labiatae.....	31	81	5	20
Cornaceæ.....	2	8	.....	2	Solanaceæ.....	9	32	6	5
Clethraceæ.....	1	1	.....	.....	Scrophulariaceæ.....	20	50	.....	5
Pyrolaceæ.....	2	4	.....	2	Lentibulariaceæ.....	1	3	.....	.....
Monotropaceæ.....	3	3	.....	.....	Orobanchaceæ.....	4	4	.....	1
Ericaceæ.....	11	19	.....	2	Bignoniaceæ.....	3	4	.....	2
Vacciniaceæ.....	3	14	.....	5	Martyniaceæ.....	1	1	.....	2
Diapensiaceæ.....	1	1	.....	.....	Acanthaceæ.....	4	6	.....	.....
Primulaceæ.....	6	14	.....	1	Phrymaceæ.....	1	1	.....	.....
Sapotaceæ.....	1	1	.....	.....	Plantaginaceæ.....	1	8	.....	2
Ebenaceæ.....	1	1	.....	1	Rubiaceæ.....	6	28	.....	3
Symplocaceæ.....	1	1	.....	.....	Caprifoliaceæ.....	7	21	.....	5
Styraceæ.....	2	3	.....	1	Valerianaceæ.....	2	6	1	.....
Oleaceæ.....	5	10	.....	3	Dipsaceæ.....	1	1	.....	.....
Loganiaceæ.....	4	4	.....	2	Cucurbitaceæ.....	9	14	.....	2
Gentianaceæ.....	5	11	.....	7	Campanulaceæ.....	3	13	.....	3
Menyanthaceæ.....	1	1	.....	1	Cichoriaceæ.....	10	35	4	12
Apocynaceæ.....	3	5	.....	2	Ambrosiaceæ.....	2	8	.....	2
Asclepiadaceæ.....	5	20	.....	3	Compositæ.....	57	224	1	36
Convolvulaceæ.....	4	12	1	1					

Total:

Families.....	151
Genera.....	755
Species.....	2218
Cultivated.....	84
Official.....	326

## Index of the Genera.

	PAGE.		PAGE.
Abies .....	32	Anthemis .....	172
Abutilon .....	119	Anthoxanthum .....	39
Acacia .....	101	Anthriscus .....	123
Acalypha .....	113	Anychia .....	78
Acer .....	115	Apiastrum .....	128
Acerates .....	138	Apios .....	108
Achillea .....	172	Apium .....	129
Achroanthos .....	163	Aplectrum .....	64
Acnida .....	75	Apocynum .....	137
Aconitum .....	80	Apogon .....	160
Acorus .....	54	Aquilegia .....	80
Actaea .....	80	Arabis .....	88
Acuan .....	101	Arachis .....	110
Adelia .....	136	Aralia .....	126
Adiantum .....	29	Aretium .....	174
Adicea .....	71	Arenaria .....	77
Adlumia .....	85	Argemone .....	87
Aesculus .....	116	Arisaema .....	53
Afzelia .....	152	Aristida .....	39
Agave .....	61	Aristolochia .....	72
Agrimonia .....	95	Aronia .....	96
Agropyrum .....	46	Arrhenaterum .....	42
Agrostema .....	76	Artemisia .....	173
Agrostis .....	40	Arum .....	53
Ailanthus .....	111	Aruncus .....	93
Alchemilla .....	95	Arundinaria .....	48
Aletris .....	58	Arundo .....	43
Alisma .....	34	Asarum .....	72
Allionia .....	75	Aselepias .....	138
Allium .....	57	Ascyrum .....	119
Alnus .....	67	Asimina .....	79
Alopecurus .....	40	Asparagus .....	59
Alsine .....	77	Asplenium .....	29
Amaranthus .....	74	Aster .....	165
Ambrosia .....	162	Astilbe .....	90
Amelanchier .....	97	Astragalus .....	106
Ammania .....	123	Athyrium .....	29
Amorpha .....	104	Atragene .....	81
Ampelanus .....	138	Avena .....	42
Ampelopsis .....	118	Azalea .....	131
Amsonia .....	137	Azolla .....	30
Amygdalus .....	101		
Anagallis .....	134	Baptisia .....	102
Andropogon .....	35	Bartonia .....	137
Anemone .....	81	Batrachium .....	82
Angelica .....	126	Bellis .....	165
Antennaria .....	167	Benzoin .....	84

	PAGE.		PAGE.
Berberis .....	83	Celastrus .....	115
Berchemia .....	117	Celtis .....	70
Beta .....	74	Cenchrus .....	38
Betula .....	67	Centaurea .....	174
Bicuculla .....	85	Centunculus .....	134
Bidens .....	171	Cephalanthus .....	155
Bignonia .....	153	Cerastium .....	77
Blephilia .....	146	Ceratophyllum .....	79
Boehmeria .....	71	Cercis .....	102
Boltonia .....	165	Chærophyllum .....	128
Borago .....	143	Chamælion .....	56
Boutelloua .....	43	Cheilanthes .....	30
Brachychaeta .....	165	Chelidonium .....	85
Brachyelytrum .....	40	Chelone .....	150
Bradburia .....	108	Chenopodium .....	73
Brasenia .....	78	Chimaphila .....	131
Brassica .....	86	Chloris .....	43
Brauneria .....	170	Chrosperma .....	56
Bromus .....	46	Chrysanthemum .....	173
Broussonetia .....	70	Chrysogonum .....	169
Brunnichia .....	73	Chrysopogon .....	35
Buchnera .....	151	Chrysopsis .....	164
Buckleya .....	71	Chrysosplenium .....	91
Bumelia .....	134	Cicer .....	108
Bupleurum .....	128	Cichorium .....	160
Bursa .....	188	Cicuta .....	129
Buttnera .....	83	Cimicifuga .....	80
		Cinna .....	40
Cabomba .....	78	Circæa .....	125
Calamagrostis .....	40	Citrullus .....	158
Callicarpa .....	143	Cladrastis .....	102
Calliophœ .....	118	Claytonia .....	76
Callitriche .....	114	Clematis .....	81
Caltha .....	79	Cleome .....	89
Calycocarpum .....	83	Clethra .....	130
Camelina .....	88	Clinopodium .....	146
Campanula .....	159	Clintonia .....	59
Camptosorus .....	29	Clitoria .....	108
Cannabis .....	70	Cnicus .....	174
Capnoides .....	85	Collinsonia .....	148
Capparis .....	89	Commandra .....	71
Capriola .....	42	Commelina .....	55
Capsicum .....	149	Conoeba .....	150
Cardamine .....	87	Conopholis .....	153
Cardiospermum .....	116	Convallaria .....	59
Carduus .....	179	Convolvulus .....	139
Carex .....	51	Coptis .....	80
Carpinus .....	66	Corallorhiza .....	64
Carum .....	129	Coreopsis .....	171
Cassia .....	102	Coriandrum .....	130
Castalia .....	78	Cornus .....	130
Castanea .....	67	Coronopus .....	85
Castilleja .....	152	Corylus .....	67
Catalpa .....	153	Cotinus .....	104
Caulophyllum .....	83	Cotoneaster .....	100
Ceanothus .....	117	Cracca .....	105
Cebatha .....	83	Cratægus .....	97

	PAGE.		PAGE.
Crotalaria .....	103	Eragrostis .....	43
Croton .....	112	Erechtites .....	173
Crotonopsis .....	113	Erianthus .....	34
Cubelium .....	122	Eriogenia .....	130
Cucumis .....	158	Erigeron .....	167
Cucurbita .....	158	Eriocaulon .....	54
Cuminum .....	130	Eriophorum .....	50
Cuscuta .....	139	Ervum .....	108
Cydonia .....	97	Eryngium .....	127
Cynoglossum .....	142	Erysimum .....	89
Cynosurus .....	45	Erythronium .....	58
Cyperus .....	48	Eulophus .....	128
Cypripedium .....	62	Eupatorium .....	162
		Euphorbia .....	113
Dactylis .....	44	Euthamia .....	165
Danthonia .....	42	Evolvulus .....	139
Dasystoma .....	152	Evonymus .....	115
Datura .....	149		
Daucus .....	126	Fagopyrum .....	72
Decodon .....	123	Fagus .....	67
Decumaria .....	92	Falcata .....	108
Delphinium .....	80	Festuca .....	45
Dendrium .....	132	Filix .....	28
Dennstædtia .....	28	Fimbristylis .....	50
Deschampsia .....	42	Fœniculum .....	127
Diamorpha .....	90	Frasera .....	137
Dianthera .....	154	Fragaria .....	94
Danthus .....	77	Fraxinus .....	135
Diapedium .....	154	Fröhlichia .....	75
Dichromena .....	50	Fumaria .....	85
Didiplis .....	123		
Diervilla .....	157	Gætesia .....	154
Diodia .....	155	Galactia .....	109
Dioscorea .....	61	Galax .....	133
Diospyros .....	135	Galeopsis .....	145
Diphylleia .....	83	Galinsoga .....	172
Dipsacus .....	158	Galium .....	155
Dirca .....	123	Gaultheria .....	132
Disporum .....	59	Gaura .....	125
Dodecatheon .....	134	Gaylussacia .....	133
Doelingeria .....	167	Gelsemium .....	136
Draba .....	88	Gemmingia .....	61
Duchesnia .....	94	Gentiana .....	137
Dulichium .....	49	Geranium .....	110
Dysodia .....	172	Gerardia .....	152
		Geum .....	95
Eatonia .....	44	Gilla .....	140
Echinodorus .....	34	Glechoma .....	145
Echium .....	143	Gleditschia .....	102
Eclipta .....	169	Gnaphalium .....	167
Eleocharis .....	49	Gossypium .....	119
Elephantopus .....	162	Gratiola .....	151
Eleusine .....	43	Grindelia .....	163
Elymus .....	48	Gymnocladus .....	102
Epigæa .....	132	Gymnopogon .....	43
Epilobium .....	124	Gynerium .....	43
Equisetum .....	30	Gyrostachys .....	63

	PAGE.		PAGE.
Habenaria .....	62	Kalmia .....	132
Hamamelis .....	92	Kneiffia .....	125
Hartmannia .....	125	Köhlreutera .....	112
Hedeoma .....	146	Koëllia .....	147
Helenium .....	172	Koniga .....	89
Helianthemum .....	121	Korycarpus .....	44
Helianthella .....	171	Kraunhia .....	105
Helianthus .....	170	Kuhnia .....	163
Heliopsis .....	169	Kyllingia .....	49
Heliotropium .....	141		
Hemerocallis .....	57	Laciniaria .....	163
Hemifcarpha .....	51	Lactuca .....	160
Hepatica .....	81	Lagerstrœmia .....	124
Heracleum .....	126	Lagenaria .....	158
Hesperis .....	98	Lamium .....	145
Heteranthera .....	55	Lappula .....	142
Heuchera .....	91	Lathyrus .....	108
Hexalectris .....	64	Lavauxia .....	125
Hibiscus .....	119	Leavenworthia .....	87
Hicorya .....	65	Lechea .....	121
Hieracium .....	161	Legouzia .....	159
Holcus .....	41	Lemna .....	54
Homalocenchrus .....	39	Leonurus .....	145
Hordeum .....	47	Lepidium .....	85
Houstonia .....	155	Leptamnium .....	153
Humulus .....	70	Leptandra .....	151
Hydrangea .....	91	Leptilon .....	167
Hydrastis .....	79	Leptochloa .....	43
Hydrocotyle .....	129	Leptorchis .....	63
Hydrophyllum .....	141	Lespedeza .....	107
Hymenocallis .....	61	Lesquerella .....	88
Hypericum .....	120	Leucothoe .....	132
Hypopitis .....	131	Ligusticum .....	127
Hypoxis .....	61	Ligustrum .....	136
Hystrix .....	48	Lilium .....	58
		Limnanthemum .....	137
Ilex .....	115	Limodorum .....	64
Ilysanthes .....	151	Linaria .....	150
Impatiens .....	110	Linum .....	111
Indigofera .....	105	Lippia .....	143
Inula .....	168	Liquidambar .....	93
Iodanthus .....	86	Liriodendron .....	79
Ionactis .....	167	Listera .....	63
Ipomœa .....	139	Lithospermum .....	142
Iresine .....	75	Lobelia .....	159
Iris .....	61	Lolium .....	46
Isanthus .....	143	Lonicera .....	157
Isnarda .....	124	Ludwigia .....	124
Isoetes .....	30	Luffa .....	158
Itea .....	92	Lupinus .....	103
Ixophorus .....	38	Lycium .....	149
		Lycopersicum .....	149
Jeffersonia .....	83	Lycopodium .....	30
Juglans .....	64	Lycopus .....	147
Juncoides .....	56	Lygodium .....	27
Juncus .....	55	Lysimachia .....	134
Juniperus .....	32	Lythrum .....	123
Jussiaea .....	124		

	PAGE.		PAGE.
Magnolia .....	79	Onopordon .....	174
Malapena .....	84	Onosmodium .....	142
Malus .....	96	Ophioglossum .....	27
Malvastrum .....	118	Opulaster .....	93
Mariana .....	174	Opuntia .....	123
Marrubium .....	144	Orchis .....	62
Marshallia .....	172	Origanum .....	146
Martynia .....	154	Ornithogalum .....	58
Matricaria .....	173	Orobanche .....	153
Medeola .....	59	Orontium .....	54
Medicago .....	103	Oryza .....	39
Meehania .....	144	Osmunda .....	27
Meibomia .....	106	Ostrya .....	66
Melampyrum .....	152	Oxalis .....	110
Melanthium .....	57	Oxycoccus .....	133
Melia .....	112	Oxydendron .....	132
Melica .....	44	Oxypholis .....	126
Melilotus .....	103		
Melissa .....	146	Pachysandra .....	114
Melothria .....	159	Panax .....	126
Menispermum .....	83	Panicularia .....	45
Mentha .....	147	Panicum .....	35
Menziesia .....	132	Papaver .....	84
Mertensia .....	142	Parietaria .....	71
Mimulus .....	150	Parnassia .....	91
Mitchella .....	155	Parosella .....	104
Mitella .....	91	Paronychia .....	78
Mohrodendron .....	135	Parsonia .....	123
Mollugo .....	75	Parthenium .....	169
Monarda .....	146	Parthenocissus .....	118
Monniera .....	151	Paspalum .....	35
Monotropa .....	131	Passiflora .....	122
Monotropsis .....	131	Pastinaca .....	127
Morongia .....	102	Paulownia .....	150
Morus .....	70	Pedicularis .....	152
Mühlenbergia .....	40	Pellaea .....	30
Muscari .....	58	Peltandra .....	53
Myosotis .....	142	Pennisetum .....	39
Myosurus .....	81	Pentstemon .....	150
Myriophyllum .....	126	Penthorum .....	90
		Peranium .....	63
Nabalus .....	161	Perilla .....	148
Nama .....	141	Petalostemon .....	104
Nelumbo .....	78	Petunia .....	149
Nemastylis .....	61	Phacelia .....	141
Nemophila .....	141	Phalaris .....	39
Nepeta .....	145	Phaseolus .....	109
Nicotiana .....	149	Phegopteris .....	28
Nothocalais .....	161	Philadelphus .....	92
Nothoscordium .....	58	Philotria .....	34
Nymphæa .....	78	Phleum .....	40
Nyssa .....	130	Phlox .....	140
		Phoradendron .....	71
Obolaria .....	137	Phryma .....	154
Oenothera .....	125	Phyllanthus .....	112
Oldenlandia .....	155	Phyllitis .....	29
Onagra .....	124	Physalis .....	148
Onoclea .....	27		

	PAGE.		PAGE.
Physalodes .....	148	Ribes .....	92
Physostegia .....	145	Ricinus .....	113
Phytolacca .....	75	Robinia .....	105
Picea .....	32	Roripa .....	86
Pieris .....	132	Rosa .....	96
Pimpinella .....	128	Rotala .....	123
Pinus .....	31	Rubus .....	93
Pisum .....	108	Rudbekia .....	169
Planera .....	69	Ruellia .....	154
Plantago .....	154	Rumex .....	73
Platanus .....	93	Ruta .....	111
Pluchea .....	167		
Poa .....	45	Sabbathia .....	136
Podophyllum .....	83	Sagina .....	77
Podostemon .....	89	Salix .....	66
Pogonia .....	63	Salvia .....	146
Polanisia .....	89	Sambucus .....	156
Polemonium .....	141	Samolus .....	134
Polygala .....	112	Sanguinaria .....	84
Polygonatum .....	59	Sanguisorba .....	95
Polygonum .....	73	Sanicula .....	127
Polymnia .....	168	Saponaria .....	76
Polypodium .....	30	Sarothra .....	121
Polypremum .....	136	Saracenia .....	86
Polystichum .....	28	Sassafras .....	84
Polytania .....	127	Satureja .....	147
Pontederia .....	55	Saururus .....	64
Populus .....	65	Saxifraga .....	90
Porteranthus .....	93	Schœnolirium .....	58
Portulaca .....	76	Schwalbea .....	152
Potamogeton .....	33	Scirpus .....	50
Potentilla .....	94	Scleranthus .....	78
Proserpinaca .....	125	Scleria .....	51
Prunella .....	145	Serophularia .....	150
Prunus .....	100	Scutellaria .....	144
Psoralea .....	104	Secale .....	46
Ptelea .....	111	Sedum .....	90
Pteridium .....	30	Selaginella .....	30
Ptilimnium .....	129	Senecio .....	173
Punica .....	124	Sericocarpus .....	165
Pyrola .....	130	Sicyos .....	159
Pyrularia .....	71	Sida .....	119
Pyrus .....	96	Sieglingia .....	43
Quamassia .....	58	Silene .....	76
Quamoclit .....	139	Silphium .....	168
Quercus .....	67	Sinapis .....	86
		Sisymbrium .....	86
Ranunculus .....	82	Sisyrinchium .....	62
Raphanus .....	86	Sitilias .....	161
Ratibida .....	170	Sium .....	128
Rhamnus .....	117	Smilax .....	60
Rheum .....	73	Solanum .....	148
Rhexia .....	124	Solidago .....	164
Rhododendron .....	131	Sonchus .....	160
Rhus .....	114	Sophia .....	88
Rhynchosia .....	109	Sorbus .....	96
Rhynchospora .....	51	Sorghum .....	35

	PAGE.		PAGE.
Sparganium .....	33	Triadenum .....	121
Spathyma .....	54	Trianospermum .....	159
Spartina .....	42	Trichomanes .....	27
Spermacoce .....	155	Trichostema .....	143
Spermolepsis .....	129	Trifolium .....	103
Spigelia .....	136	Trillium .....	60
Spinacia .....	74	Triosteum .....	156
Spiraea .....	93	Tripsasum .....	34
Spirodella .....	54	Trisetum .....	42
Sporobolus .....	40	Triticum .....	47
Stachys .....	145	Tsuga .....	32
Staphylea .....	115	Typha .....	33
Steironema .....	134	Ulmaria .....	95
Stenanthium .....	56	Ulmus .....	69
Stenophragma .....	88	Unifolium .....	59
Stenophyllus .....	50	Uniola .....	44
Stillingia .....	113	Urtica .....	70
Stipa .....	40	Urticastrum .....	71
Streptopus .....	59	Utricularia .....	153
Strophostyles .....	110	Uvularia .....	57
Stuartia .....	119	Vaccinium .....	133
Stylophorum .....	84	Vagnera .....	59
Stylosanthes .....	106	Valeriana .....	157
Styrax .....	135	Valerianella .....	157
Symphoricarpus .....	157	Verbascum .....	149
Symphytum .....	142	Verbena .....	143
Symplocos .....	135	Verbesina .....	171
Synandra .....	145	Vernonia .....	162
Sydesmon .....	81	Veronica .....	151
Synosma .....	173	Viburnum .....	156
Syntherisma .....	38	Vicia .....	107
Syringa .....	135	Vigna .....	110
Talinum .....	75	Vinca .....	137
Tanacetum .....	173	Vincetoxicum .....	138
Taraxacum .....	160	Viola .....	121
Taxodium .....	32	Vitis .....	117
Taxus .....	33	Waldsteinia .....	94
Tecoma .....	153	Washingtonia .....	128
Tetragonia .....	76	Woffia .....	54
Tetragonotheca .....	169	Woodsia .....	28
Teucrium .....	143	Woodwardia .....	28
Thalesia .....	153	Xanthium .....	162
Thalictrum .....	82	Xanthorrhiza .....	80
Thaspium .....	127	Xanthoxylum .....	111
Therophon .....	91	Xerophyllum .....	56
Thlaspi .....	86	Xolisma .....	132
Thuja .....	32	Xyris .....	54
Thymus .....	147	Yucca .....	58
Tiarella .....	91	Zannichelia .....	33
Tilia .....	118	Zea .....	34
Tipularia .....	64	Zinnia .....	169
Toxylon .....	70	Zizania .....	39
Trachelospermum .....	138	Zizia .....	129
Tradescantia .....	55	Ziziphus .....	117
Tragia .....	113	Zygadenus .....	56
Tragopogon .....	160		
Trautvetteria .....	81		

## PHILOSOPHY OF BOTANY.

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“Naturae vero rerum vis atque majestas omni nimirum momento fide caret, si quis modo partes ejus ac non totam contemplatur animo.” (Plin. Hist. Nat.)

The power and greatness of the works of nature lose of their true comprehension in nearly every instance when the mind seizes on particulars and does not embrace the whole.



# An Epitome of the History and Philosophy of Botany.

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“Opinionum commenta delet dies, naturae judicia confirmat.” (Cicero.)

In the history of mankind we observe three consecutive stages of culture. In the first we find men ceaselessly engaged in the dire struggle for the daily wants of maintenance and in self-defense until they acquire the faculty of providing for regular sustenance and enter into the social state. They arrive now at a state of mental composure, inducing a spirit of inquiry into the nearer or remoter relation of things around them, and their applicability to their benefit or pleasure. Thus engaged, they collect the material for the third state of their education, in which they acquire a comprehension of moral law, an interpretation of the physical forces, and ultimately attain to the ability to control them and make them subservient to their will.

Likewise we may arrange the history of botany in three periods—of, however, very unequal duration, and, like the former, disturbed, especially in the earlier states, by periodic fluctuations.

The first period embraces the whole time from the incipency of human culture to the late periods of mediæval history, from Dioscorides and Theophrastus to the Bauhins (1600), in which plants were nearly exclusively attended to in relation to their applicability to the healing art, to agriculture and horticulture, and as material for wood-work.

The second period, beginning with Rajus and Turnefort, reaches its acme in the Linnean school, and is strictly confined to technical botany; that is, the exact description and artificial systematizing.

The beginning of the third and really scientific period lies within the recollection of botanists yet living, who surveyed and coöperated in the rapid ascendancy of this discipline.

In this instance plants are treated from the biologic stand-

point, as living organisms developing in definite phases of growth and reproduction with regard to their affinities among themselves, their analogies to animal and human life, their dependencies from the elements in which they are placed, the mutual dependencies among themselves, as also upon animal life, and ultimately the human race itself. Even the function of the human intellect is shown to be intertwined with the phenomena of their sensitiveness resembling volition. With the scrutiny of the origin and meaning of life they help to transport us in the sphere of philosophy, the sublime terminus of science.

The earlier phases of the development of any particular science cannot be followed up otherwise than along the line of general intellectual progress, following the plan of gradual specializations. How this process evolved in the struggles with the floods and eddies of history I wish to depict within the smallest possible compass, with the special aim to point out the interferences which even at this day have not ceased to make themselves felt. I intend to proceed like a navigator who sails around a continent, directing his course from promontory to promontory. To follow the coast line and exploringly to ascend the rivers would be the work of an historian.

The birthplace of all ideal creations of the human mind and also of the natural sciences is ancient Athens, and the origin of scientific botany is one of the latest fruits which matured from the flowery epoch of Greece. Great statesmen, heroes, genial artists, poets, and philosophers had in unbroken succession followed each other in the interval of one hundred and fifty years between the battles of Salamis and Arbela, and the Hellenic genius appeared to exhaust itself in the luxuriance of its productions. The first school of philosophy was a natural philosophy, known under the name of the Ionian school. It originated with Thales, the Milesian, who first calculated the length of the year to be three hundred and sixty-five days, and was the first who predicted a solar eclipse and called water the passive principle in nature. His friend and disciple was Anaximander, also born in Miletus. He taught that the universe, though variable in its parts, as one whole is immutable. The invention of the sundial is ascribed to him. Anaximenes, also

a Milesian, born B.C. 556, conceived the air or ether endowed with a divine principle and the celestial bodies of fiery nature. Anaxagoras, of Clazomene, taught philosophy in Athens B.C. 500, and among his pupils were Euripides, the tragedian; the orator and statesman, Pericles; Socrates, and Themistocles. He originated the idea of the dualism of mind and matter. For his assertion that the so-called divine miracles of the times were nothing more than common natural effects he was accused of impiety toward the gods, thrown into prison, condemned to death, and barely escaped through the influence of Pericles. He fled to Lampsacus, where he ended his days in exile.

The antagonism between learning and Polytheism had commenced, and became from day to day more apparent. The natural result of such a state of things was to force the philosophers to practice concealment and mystification, as is strikingly shown in the history of the Pythagoreans.

This school was started by Pythagoras in Croton, in Lower Italia, a province called Grecia Magna. Pythagoras had lived a long time in Egypt among the priests of Thebes, by whom he was introduced into their religious secrets. All wisdom and learning was held there by the sacerdotal class, and their tenets were kept concealed from the common populace, which was taught to receive with submission and obedience the doctrines and tenets of the order. The independent Hellenic character would, however, not bend to such rulings, and they could only practice their tenets within their own fraternity.

Pythagoras was born in Samos in the time of Tarquinius Superbus. He was the first to use the term "philosophus." Out of esteem for his sublime wisdom the people would call him "Sophos" (the wise one). He declined this honor, saying that he was only a philosophus, a friend of wisdom. The most important dogma of his school is the assertion that the divinity is the soul of the world, of which the human soul is an emanation, and that it will revert again into the former after its migrations through many bodies. He laid a firm foundation for the science of mathematics among the Greeks.

Besides the Pythagorean flourished also the Eleatic school of philosophers, of which Xenophanes, of Kolophon, is the

founder. The basis of their doctrine was Pantheism, the union of all things into one indivisible whole; that God and the world are one and the same.

From these schools, which were engaged in speculating about the nature and origin of things, we turn now to the Socratic school, of which Socrates, the son of Sophroniscus (B.C. 469), was the founder. His father was a statuary, and his mother, Phaenarete, a midwife. In his youth he followed the trade of his father, and became a successful artist. Later, and under the protection of Crito, a wealthy Athenian, to whom he served as an instructor of his children, he gave up his occupation and attached himself to the school of Anaxagoras, Archelaus, and others, and became master of every kind of learning which the age in which he lived could afford. For three times in succession he also served his country in military capacity with great distinction. After he had reached an age of nearly fifty-six years, he, for a while, served in a civil office in the Senate of the Five Hundred. From his wide experience in public life he had regretfully observed how much the opinions of the Athenian youth were misled and their principles and taste corrupted by philosophers, who spent all their time in refined speculations upon the nature and origin of things, and by sophists, who taught in their schools the arts of false eloquence and deceitful reasoning. To amend this evil he conceived the wise and generous design of instituting a new and more useful method of instruction. He justly concluded the true end of philosophy to be, not to make an ostentatious display of learning and oratory, but to free mankind from the dominion of pernicious prejudices, to correct their vices, to inspire them with the love of virtue, and thus conduct them over the path of wisdom to true felicity. His method of instruction was in the form of dialogue, in which he endeavored without persuasion to deduce the truths of which he wished to convince a person as a necessary consequence of his own concessions. His favorite maxim was: "Whatever is above us does not concern us." He estimated the value of knowledge by its utility, and recommended the study of geometry, astronomy, and other sciences only so far as they admit of practical application to the purposes of human life.

Cicero said of him that he was the first who called down Philosophy from heaven to earth and introduced her into the public walks and domestic retirements of men, that she might instruct them concerning life and manners.

His continuous, severe arraignment of the horde of sophists, hypocritical priests, and selfish politicians gave rise to a party of dangerous and unscrupulous enemies. His endeavor to engraft upon the mind of the youth the idea of the existence of one supreme Being threatened the interests of the priesthood, who stirred up the fanaticism of the common people by denouncing him as a contemptor of the gods. Although he was in the seventieth year of his age, they could not await his natural demise. The accusation was delivered to the Senate in the name of Melitus, and read thus: "Melitus, son of Melitus, of the tribe of Pythos, accuseth Socrates, son of Sophroniscus, of the tribe of Alopeces. Socrates violates the law in not acknowledging the gods, which the State acknowledges, and by introducing new divinities. He also violates the laws by corrupting the youth. Be his punishment death." After a mock trial, he was condemned to be put to death by the poison of hemlock. Thus died one of the most virtuous men, a victim to priestcraft and unscrupulous politicians.

With truth Socrates said at the close of his speech in self-defense to the judges who had condemned him: "It is now time that we depart—I to die, you to live; but which has the better destiny is unknown to all except God." His memory was honored and his name immortalized by two of his disciples, who became his biographers, Xenophon and Plato. It was also a blessed termination of an advanced period of life to die in behalf of virtue and morality.

After the passing away of Socrates, other schools arose professing to be founded upon his principles—the Megaric, headed by Euclid; the Cyrenaic, founded by Aristippus; and the Cynical school, originated by Antisthenes. It is a melancholy aspect to contemplate the sudden upset of sublime thought into moral mire of those sophistical extremists. The name of Diogenes, of Sinope, has come down to us as an inimitable example of a humorous pessimist. This temporary eclipse of the Hellenic genius soon passed over, recognized as a discred-

itable delusion. Like a metempsychosis of the soul of Socrates, his chief disciple, Plato, continued and embellished the work of his master. To the bent of mind attained in the society of Socrates within eight or ten years he added all that could be obtained from the philosophers of Egypt, Cyrene, Persia, and Tarentum. Of noble and illustrious parentage, he numbered Solon among his ancestors; also possessing the advantage of wealth, he concluded to establish a school in the grove of Hecademus. There he devoted himself to science, and spent the last years of a long life in the instruction of youth, and, arriving at the eighty-first year of his age, died from gradual decay of nature. His portrait is preserved to this day in antique gems, but the most lasting monuments of his genius are his writings, which have been transmitted without material injury to the present time.

The powerful effect of the writings of Plato is equally produced by their external form as by their internal value. The elegant world of letters which so readily sacrifices the essence of a literary production to the form in which it is presented would never have paid such homage to Plato had it not been for the art of presentation and introduction of his ideas, which he knew how to handle in a masterly way. Even when he chastises his sophistic adversaries with pungent ridicule, he never passes beyond the limits of decency and dignity.

All his works are rendered in dialectic form, displaying an equally philosophical and poetical style. Various as were the models of literary style which he had before him, to none, however, was he more indebted than to Aristophanes, the comedian, in depicting the life and actions of men. He also made much use of Indian and Egyptian myths and mysteries, and handled with great caution in those discussions questions which penetrated into the field of the religious faith of his countrymen. Many sentences are obscure and ambiguous to avoid conflict. He knew of the dismal fate which shortly before his day had overtaken Anaxagoras; Diagoras, of Melos; Protagoras, of Abdera; and Prodicus, of Keos—all of whom were prosecuted for alleged irreverence against the gods. The latter was first banished, his writings publicly burned and their possession and sale interdicted, and he himself condemned ul-

timately and executed. This is the first instance in the annals of history of the procedure of public combustion of condemned writings.

While at this epoch several speculative, philosophical schools flourished; the arts, dramatic poetry, and oratory had reached the climax of perfection; and peace reigned on the western side of the Hellespont, the Macedonian campaign in Asia, the culminating point in the strategy of ancient history, swept over the Persian Empire, crushing the hereditary foes of Greece. The daring and gifted son of the shrewd Philip of Macedon, had in rapid strides subdued all the eastern nations from the oasis of Jupiter Ammon to the distant Bactria. In the short space of time between the battle on the Granicus (June, B.C. 334) to the battle at Arbella and Gaugamela (October, B.C. 331) the whole of the Persian Empire, with all its outlying appendages, had, by right of conquest, become the property of the victor. With the death of Darius (July, B.C. 330), Alexander became also the legitimate heir to Darius, the king, in accordance with Oriental custom and traditions.

The unrestrained and ambitious Alexander came to a halt only through the irrepressible objection of his entire army after crossing the Indus in its upper course. He met and defeated there Porus, an independent ruler, in the populous and rich Pendschab. Here the Macedonians for the first time faced the peculiar Indian armament, a train of armed elephants, who, though fierce and valiant fighters, could not withstand the undaunted valor of Alexander's warriors. The shores of the Hyphasis, an eastern tributary of the Indus, on the foot of the Himalayas, became the terminus of his advance. The reduction of Persia was an act of policy and retribution. Further extension of dominion would only glorify personal ambition, would be an impious frenzy. In a general council of war the return was insisted upon, and the order for return met the greatest gratification of the soldiers, whose homesick hearts grieved for Hellas and the Olympian games. At the end of the summer (B.C. 326) the home march was commenced, and continued into Persia under many difficulties and exposures. Engaged with plans for the consolidation of his empire, he designed to make Babylon his future residence.

There his premature death ended his career, and the ungovernable expanse of territory became divided among his generals.

Great as were the political results of the Macedonian expedition, they were equaled by the intellectual. A longing had taken hold of the minds to descend to the roots from which sprung the fascinating Platonic ideas.

Penetrating into the tropical climate of India, with its diversified fauna of big or fierce species, gigantic vegetation displayed in impenetrable bamboo jungles, and entering into the ancient seats of culture older than the one of the pyramid builders, with a national character disposed to quiet contemplation, the conquerors were yet more amazed by the contrast of life and manners of the conservative Indian people with their own progressive, stormy, vacillating national life. Their experiences—political, geographical, ethical—were destined to prepare a reaction upon Grecian life and thought. The intermixture of Greek elements among the immense throngs of the Oriental nationalities sufficed only for a transient stir, after which they relapsed again into their hereditary quietism. The Greek character, on the contrary, took in much of the novel and foreign element.

In the resulting new empires governed by Grecian rulers, Grecian ideas were soon universally felt, but nowhere with such lasting effect as in the domain of the Ptolemeans and in the city founded by Alexander, Alexandria, the cardinal point around which in the near future ruled the intellectual progress of Europe for several centuries. It is an unparalleled incident in history that the same period could produce a genius competent to understand the existing philosophical systems and to remodel and enlarge all sciences (Aristotle), and also a hero of cultivated mind, attentive to progress, and unlimited ability for execution (Alexander).

Aristotle was born in Stagyræ, a town in Thracia, belonging to the dominion of Philip, king of Macedon, B.C. 384. He was the favored disciple of Plato, and remained in the academy to the time of the death of his master, when he was thirty-seven years of age. Philip, having heard of his extraordinary abilities, invited him to his court, and put him in charge of his son, Alexander, who was then (B.C. 343) fifteen years of age.

Honored with the esteem and confidence of the king, he enjoyed a true filial attachment of the juvenile Alexander, with whom he remained until he opened his Asiatic campaign. After Aristotle had thus left his pupil, they carried on a friendly correspondence, in which the philosopher prevailed upon Alexander to employ his increasing power and wealth in the service of philosophy by furnishing him in his retirement with the means of enlarging his acquaintance with nature. Alexander responded to this request with an abundant supply of specimens of objects of natural history from both animal and vegetable kingdoms, and which were either maintained in zoölogical gardens or preserved in a museum. Upon this collection he composed a work of fifty volumes on the history of animated nature, only ten of which are now extant. He also wrote on the nature of plants, and collected notes and observations from scattering writings on natural history for centuries before him. He arranged his objects in systematic disposition, created a scientific language for exact definition, and taught the graduations into classes, genera, species, and individuals. This made him the creator and founder of natural history.

He was an exceedingly productive writer, and his utterances were the illuminating beacon of philosophy and science for all nations for twenty centuries. The writings generally received under his name may be classed under the heads of logic, physics, metaphysics, mathematics, ethics, rhetoric, and poetry.

After his departure from Alexander, Aristotle returned to Athens and resolved to acquire the fame of a leader in philosophy by founding a new sect, in opposition to the academy, and teaching a system of doctrines different from that of Plato. He chose a place in the suburbs of Athens, a grove, called the Lyceum. From his habit of walking while he delivered his discourses his followers were called Peripatetics. He continued his school for twelve years.

The philosophical method of Aristotle is the inverse of that of Plato, whose starting point was universals, the very existence of which was a matter of faith, and from there he descended upon particulars or details. Aristotle, on the contrary, rose from particulars to universals, advancing to them

by inductions; and his system, thus an inductive philosophy, was in reality the true beginning of science.

Here it must be observed that, notwithstanding his correct and scientific method, his time was not in possession of the sufficient knowledge needed to support such a vast edifice as he aimed to construct, and many of his statements are assertions deficient in proof. The superiority of his abilities and the novelty of his doctrines created him many rivals and enemies, against whose assaults he was well shielded through the influence of his friend, Alexander; but after the death of Alexander the fire of jealousy burst into a flame of persecution. Eurymedon, a priest, was instigated to accuse him of holding and promulgating impious tenets. Opinions of his, pointing to the denial of the necessity of prayers and sacrifices, were to be resented as inimical to existing religious institutions. Aristotle became apprehensive of meeting the fate of Socrates, and concluded to retire and leave Athens. "I am not willing," says he, "to give the Athenians an opportunity of committing a second offense against philosophy." He departed for Chalcis, where he died in the sixty-third year of his age.

When Aristotle withdrew from the charge of the Peripatetic school in the Lyceum, his disciples importuned him to nominate a successor. In compliance with their request, he appointed to the chair one of his favorite pupils, Theophrastus. B.C. 323. This philosopher was a native of Eresus, in Lesbos. He had studied under Alcippus, Plato, and Aristotle. When he undertook the charge of the Peripatetic school, he conducted it with such high reputation that he had about two thousand scholars, among whom were Nicomachus, the son of Aristotle, whom his father intrusted, by will, to his charge. He lived to the advanced age of eighty-five. His last advice to his disciples was that "since it is the lot of man to die as soon as he begins to live, they would take more pains to enjoy life as it passes than to acquire posthumous fame." He wrote many valuable works, of which all that remain are two books, "On the Natural History of Plants" and treatises "On Fossils and Metaphysical Fragments." With this work he laid the foundation of the scientific botany.

That some plants were known by specific names long before Aristotle and Theophrastus is quite evident. Of many their real or alleged wholesome or noxious qualities were known to pharmacoplists, others to gardeners for adornments in use by religious ceremonies or for sorcery. Vintagers and agriculturists had made and collected observations and experiments with the cultivated plants, and much empirical knowledge in aid of success and profit in culture had accumulated and was in general circulation. But efforts directed toward lucre and increase of wealth only do not possess the elevating moral character of science. This term signifies the operation of such an intellectual energy which is spent in the discovery of truth or the elimination from our judgments of that which is false, impure, or confused.

Science begins as soon as the student commences to analyze critically observations made by himself or others, to associate their relations, and to bring to light the remote or occult sources of externally visible phenomena.

With this motive in his mind Aristotle founded the science of nature in general, and Theophrastus became the father of scientific botany. Not only that, but he collected a surprising array of trite and simple observations upon native and exotic species gathered from the columns of Hercules to the plains of the Euphrates and the waters of the Indus, from the cataracts of the Nile to the shores of the Pontus; he did not confine his attention to vegetables of common utility only, but he inquired with equal zeal into the nature of the humblest plants when they appeared to him to confer to the solution of general problems, which was the main object of his studies. He queried: Wherein consists the difference between plant and animal? Which are the organs of the plant? What is the function of root, stem, leaves, and fruit? To what age do plants attain? What causes them to take on disease? How can their diseases be prevented or be remedied? What influence on their thrift exert heat or cold, moisture or dryness, external injuries or excessive fruit bearing, care or neglect of cultivation, soil or climate? Can a plant originate spontaneously? Can one species transform itself into another one? How do plants grown from seed differ from those grown from

cuttings? With such and similar inquiries dealt Theophrastus. They were in the main the same ones which yet in our day occupy the attention of the botanist.

It is in the proposition of these questions, rather than in the answers to them, wherein the scientific maturity of the school of Aristotle manifests itself. The preparatory studies which ought to have preceded were as yet entirely insufficient. Very pointedly remarks Goethe: "If one takes a view of the problems of Aristotle, one is seized with surprise at the ingenuity of observation and universality of attention by the Greeks. Yet they fall into error from presumption, as they do, with too much haste, jump from the phenomenon to the explanation of its cause, whereby they construct incomplete and untenable theories." Could any one of the two thousand attendants assembled in the arcades of the Lyceum at Athens, listening to the discourses of Theophrastus, have been brought to think that the rearing of the scientific structure so auspiciously initiated would soon experience a subsidence of nearly two thousand years before the work could be continued and ultimately carried to perfection as planned by its inventor? But the upheaval, political as well as intellectual, of that age was so immense that also the stability of philosophical principles became affected. Greece and Macedonia were involved in continual rebellion and wars, reducing the population, laying waste the land, destroying the industries. Last the Romans found an opportunity to settle their quarrels. A Roman army under the command of Cecilius Metellus occupied Macedonia after the defeat of the strategus Andronicus (B.C. 148), and two years afterwards, in a renewed campaign, the whole of Attica fell into the hands of the rude and ignorant Lucius Mummius, who wantonly ruined and despoiled Corinth. The whole of Greece was now annexed to the Roman Empire under the administration of a Roman prætor.

The policy of Alexander the Great to amalgamate, as it were, Oriental and Greek culture utterly failed in the Asiatic States by absorption of the Greek character into the Oriental. The reverse occurred in the city of Alexandria, the capital of the Ptolemeans.

I am glad to record here an act of Alexander which embel-

lished his philosophical and liberal character as much as his heroism and victories immortalized his name as a strategist and statesman. When he built the city of Alexandria and peopled it with immigrants from various countries, opening a new seat for philosophy, he granted a general indulgence to the promiscuous crowd assembled in this rising city, whether Egyptians, Grecians, Jews, or others, to profess their respective systems of philosophy and religion without molestation. The consequence was that Egypt was soon filled with religious and philosophical sectaries of every kind, and particularly that almost every Grecian sect found an advocate and professor in Alexandria.

The family of the Ptolemies, who, after Alexander obtained the government of Egypt, from motives of policy and personal enlightenment, encouraged this new establishment. Ptolemy Lagus removed the schools of Athens to Alexandria. In order to provide in Alexandria a permanent residence for learning and philosophy, he laid the foundation of a library, which after his time became exceedingly famous; granted philosophers of every class immunity from public offices; and encouraged science and literature with royal munificence. His successor, Ptolemy Philadelphus, added to the library, and instituted a college of learned men, who, that they might have leisure to prosecute their studies, were maintained at the public expense.

The ethical character of this period displayed a marked inclination to utilitarianism, and, with the development of wealth and luxury, a desire to adorn refined sensualism with metaphysical speculations. In such times may only such learning and such sciences flourish which are applicable to external wants, as are mathematics, mechanics, physics, and medicine.

In the natural sciences the Alexandrian school continued to build upon the foundation laid by Aristotle and Theophrastus, but unfortunately assumed again much of the speculative way of Plato. Physiology and anatomy, chemistry and botany profited by it. Herophilus and Erasistratus founded two opposing medical schools. The former annexed botany to the medical curriculum.

Under the last of the Ptolemies appeared the celebrated botanist, Dioscorides, whose writings stood out as the guide and groundwork in botany for the Arabs as well as the Occidental nations to mediæval times.

Alexandria can also boast of having produced or supported Eratosthenes, Euclid, and Archimedes in mathematics, and Hipparchus, the greatest astronomer of ancient time.

Of the many writings of Dioscorides have been preserved his work, "De Materia Medica," and the "Alexipharmaca; or, About Poisons and Antidotes." His death occurred toward the end of the first century of the Christian era, while the fame of the Alexandrian school was yet at its climax.

Philosophy during this period suffered a grievous corruption from the attempt which was made by philosophers of different sects and countries—Grecian, Egyptian, Oriental—who were assembled in Alexandria to frame from their different tenets one general system of opinions. Herein originated Neo-Platonism, a religious philosophy, distinguished for the conflict it maintained with the rising power of Christianity. Its author was Plotinus, an Egyptian, born about A.D. 204.

Another outcrop of this connubium is the Cabbala, a Jewish sect. This system contains some profound tenets, polluted with many erratic superstitions. One of these asserts that God had imprinted upon all plants certain marks, from which the initiated and gifted could read their manifold qualities. Adam, in paradise, is said to have been instructed by God himself, but to have lost the secret when he was expelled from paradise. It was revealed again unto Solomon. The name of one of our liliaceous plants, "Solomon's seal" (*Polygonatum officinale*), points to this myth. (Doctrine of signatures.)

The poetical, romantic, and inquisitive spirit of the Aristotelian time had died out. One part of humanity was depressed by intellectual inertia produced from absolute realism or sensual debauchery; the other lay chained by remorseless oppressors, with no hope to free themselves by their own valor. The hearts of men ached with a desire for a new order in the affairs of humanity, grieved with a desire for some source of delivery.

Not one of the countries subject to the Roman rule had suf-

ferred a greater degradation than Judea, at that time governed by the vicious tyrant, Antipater. More vivid than ever before in the hardest trials grew the expectancy of the pious Jews of the advent of the deliverer, the messenger of Jehovah, who should, as promised by the prophets, deliver them from their oppressors and be the God-appointed King over the chosen people, to reside in Jerusalem. The learned classes of Syria and Palestine were habitually disposed to disputations upon the meaning of their own ancient religious literature. The Hebrew language was already a dead language and the holy writings in the hands of the Levites and the scribes as interpreters. The ancient creed divided in three opposing sects, one of which, the sect of the Esseniens, distinguished themselves by their religious devotion and purity of life. Among the Esseniens formed a separate society, who endeavored to perfect themselves by acts of penitence and self-inflicted torments, the Nasireans. John the Baptist was a member of this sect. He was a cousin of Jesus, taught the doctrines of the Esseniens, urging his hearers to repentance and good conduct, and immersed in water, as an emblem of purification, all those who promised to follow his exhortations. When Jesus (the son of Joseph and Mary, of poor, but noble, lineage) came to him, he also submitted to this symbol, and was then declared by John as the expected Messiah. Without doubting the correctness of the statement as given by the evangelists, there is, however, a large scope for comment by the student of the comparative history of religions. The Essenien doctrines were very much the same as those of the Buddhists. They also used ablutions in water as a symbol of purification of the heart. In like manner did the Buddhists, on command of their master, send out missionaries in all lands to spread their doctrines.

In this simple and unpretending language of Christ exhorting to justice, love, and forbearance; in the exalted example of his pure and noble life, the fidelity of his mission sealed by his death, humanity received the guide to the accomplishment of the heavenly promise of peace to man upon earth, to the only one possible happiness in a necessarily imperfect world. But he was ill understood during his own life even by those

nearest to him, and humanity proved itself unworthy of his promise at his ultimate departure that he would send that Holy Spirit that would teach them every truth; for truth nearly two thousand years had to pass before this Holy Spirit could assert his influence in the revelations of science. Christianity, however, is not a reform of Judaism, a mere advance beyond Philo, but a synthesis of the Semitic and Aryan thought, and its strength lies in its power to calm the cravings of the heart and satisfy the postulates of reason. On these premises will stand the Christianity of the future.

Far removed as the essence of the divinity is in the ancient Jewish faith, even as close are both the natures drawn together through the idea of the Logos, a concept of thoroughly Greek origin, explained already by Heraclitus, Zeno, and Athenagoras. Christianity, confined to Jerusalem, would never have advanced beyond the Talmud. Its influence on the world at large began with the conversion of men who then represented the world, who stood in the front rank of philosophical thought, who had been educated in the schools of Greek philosophy, and who, in adopting Christianity as their religion, showed to the world that they were able honestly to reconcile their own philosophical convictions with the religious and moral teaching of Jesus of Nazareth. Those who are truly called the fathers and founders of the Christian church were not the simple-minded fishermen of Galilee, but men who had received the highest education which could be obtained at that time; that is, Greek education. In Alexandria, at that time the very center of the world, it had to either vanquish the world or to vanish. In the Catechetical school in Alexandria it took a definite form. St. Paul had made a beginning as a philosophical apologete, but St. Clements was a far superior champion to the new faith.

It is unmistakably true that in the early days the Christian mind was inclined to demonstrate in the order of this universe and from the beauty of nature the greatness and benevolence of its author. Such a bent of the mind to glorify the divinity through the description of its works created a taste for descriptions of natural scenery. Some beautiful versions are found in the homilies of ecclesiastical writers in the time of Ter-

tullian. This disposition of a purely emotional character might have in time of social quietude assumed a proneness to the inquiry into the intellectual causation of natural phenomena and reëstablished the Aristotelian methods.

To the great detriment of Christianity, ultimately to the fate of humanity, the Christian teachings were interwoven with accounts of miracles, quite unessential as to the validity of the precepts, even incompatible with the dignity of the Master in the consideration of the enlightened and philosophically inclined. More than any other weakness of human nature did the forcible burdening of the consciences with unprovable tenets extinguish in the hearts of men the divine love and forbearance kindled by the Master. When the light of reason is put out, error becomes incorrigible and faith turns into fanaticism.

The fateful disposition of the human mind to anticipate events before the law of causation is comprehended or appreciated, invites premature speculation, credulity, superstition. Preferment of the decisions of authority in the presence of contradictory, established physical laws and dictates of plain reasoning is a vicious or perverted constitution of the will, the eternal enemy of truth and science, the Pandora box of history, the object of active and unrelenting warfare, and will find its overthrow through the improved arms and methods of the natural sciences.

Should a continuous progress of the sciences only be depicted, one should stop with the era of the Ptolemeans and the names of Dioscorides, Archimedes, Manetho, and Hipparchus, or Euclid, and resume again the thread of history with the close of the thirty-years' war, the last religious war, with the treaty of peace at Schmalkalden in the year A.D. 1648. This was the first international pledge for parity of religious confessions.

Such a psychological condition hovered over the mystery-brooding minds of mankind at all times, with ever less control by reason and experience, the farther back we reach in the annals of history; fate and destinies of mortals a play ball thrown about in the heavenly courts for the amusement of the gods. Deeper minds only recognized the "irrevocable fa-

tum " to which even the gods had to bow. That all events in space and times are subject to unimpeachable laws was not understood at all or very imperfectly comprehended. Men had an estimate of the ordinary course of things from a limited experience. To interrupt or to set aside the rules of government in the physical and ethical world was held to be an undisputed privilege of the gods. A fear of this power invited veneration and worship. A breach in the laws of nature was with them an incontrovertible evidence of divine power. When the silent and undesigned beginnings of the new creed in salvation by faith crystallized itself around the person of the great teacher, Jesus of Nazareth, the Redeemer, the legendary Orientalic persuasion was largely called in aid for the accrediting of his person, and was accepted as an essential part of the first apostolic creed and catechism as composed in the Catechetical school in Alexandria, where also the first ecclesiastic or episcopal establishments were organized.

The study of the historical development of Christianity confirms the sad experience that men will convert into disaster what God had bestowed upon them for a blessing, and that ambition and creed will seize upon religion the same as they do likewise upon patriotism and every other noble inspiration.

The simple teaching of pure truth had been estranged from its original designs long before Constantine the Great had raised it to the dignity of the religion of the empire through the organization of the hierarchy, the establishment of dogmatic systems, and the parade of a pompous service, making it subservient to the wants of government, the entertainment of the masses, and the pride of the nobility. By these methods became Christianity completely adapted to step into the place of the old pagan religion, and Constantine acted fully in conformity with the spirit of his age when he accepted the new faith.

These events were absolutely fatal to the maintenance of a spirit of inquiry. Wisdom and learning degenerated, especially in sequel of a totally changed system of education and instruction by conferring the care and supervision over the schools upon the Christian clergy, in opposition to the rhetors

of Athens, Antiochia, and Ephesus, who still maintained the old doctrines.

The plan of the new system intended to discourage individual, independent thought. The youth was to be brought up in humility, faithfulness, and "laissez-faire" manners. Men of strength of character and self-reliance were considered dangerous to the hierarchy and its dictates. In place of the poets, philosophers, orators, and historians of the old time, which had formerly served as manuals of instruction to the students, the holy writs of the Old Testament were supplanted. A religion which was originally intended for the awakening of pious emotion, love, and justice, and which was well preached by the untaught apostles and their followers, was converted into a collection of sophistical subtleties, and attendance to disputations and partaking in ecclesiastic ceremonies formed the prominent entertainments of the society of those days.

I had to interrupt the chronologic order to forestall the events under whose influence the Christian clergy acquired control of the education of the youth in the Eastern Empire to bring it in closer connection with the same events in the Western Empire.

The great civil war, the contest for supremacy between Cæsar and Pompejus, had ended with the defeat of the latter in the battle of Pharsalus, which sealed the downfall of the Roman republic, the occupation of Egypt by Cæsar, the assassination of the dictator. Then followed the tragic death of Cleopatra, the last heir to the Ptolemean throne; the incorporation of Egypt into the Roman Empire under a Roman prætor. All these revolutions exerted but little influence upon the Alexandrian schools. At the time of the destruction of Jerusalem the Sceptics and Gnostics shared equal authority. Within a short period Christianity had made a great many conversions, and came into ascendancy, and Alexandria became one of the three rivaling bishoprics, the other two being Constantinople and Rome.

The Christian church had been divided in regard to administration and tenets from the very beginning. For a while tolerance and even liberality prevailed toward difference of opinion. Not until the council of Nicæa appeared the name

of "heretic" in a vindictive sense, and an equality of rights of membership was observed solely upon the confession of the apostolic creed. The first act of grave violence was committed by Theophilus, bishop of Alexandria, in the destruction of the Serapium, the most magnificent structure in the East, the relic of the statesmanship of Alexander's captains, the connecting link between the ancient cult of Egypt and free-thinking Greece.

From this period on there was no longer any thought of science. The sects became numerous, their contests violent; theological discussions ended in bloody riots and wholesale murders. The religious sermons delivered in the churches were accompanied by clapping of the hands and shouting of the audience, like theatrical performances.

In the midst of raving and wrangling of sects between Aryans, Nestorians, Monophysites, Eutychians, and the mutual anathematizing of rioting powers appeared the Khalifa Omar, with his invincible army, who entered the gates of the city, burned the museum and great library, and the dark cloud of Moslem fanaticism henceforth overshadowed the realm of the Pharaohs.

The appearance of Mohammed and the promulgation of his religion was adverse to progress in science and philosophy during the first ages of Islam. This impostor thought it necessary to keep his followers as ignorant as himself. That he might at once cut off impertinent contradiction, he issued an edict which made the study of liberal sciences and arts a capital offense. At the same time to captivate the imaginations of his ignorant followers, and thereby establish his authority, he sent forth in separate portions a sacred book, to which he gave the name of the Koran, containing the doctrines and precepts of his religion. This book, which was chiefly a compilation, sufficiently injudicious and incoherent, from the books of the Nestorians, the Jews, and ancient Arabic superstitions, long continued the only object of study among the Mohammedans. Their reverence for this holy book, the leaves of which, they were taught to believe, were communicated to the prophet by an angel from heaven, long superseded every philosophical and literary pursuit. Imagining that the Koran contained

everything necessary or useful to be known, whatever was contrary to its dogmas was immediately condemned as erroneous, and whatever was not found in this sacred volume was dismissed as superfluous.

After the extinction of the Omniades, who trod into the footsteps of Mohammed, the accession of the family of Abbassides to the Khalifat opened again the dawning of philosophy in the East.

Of all the ancient peoples, none perhaps were less inclined to materialistic conceptions than the Romans. With a religion deeply rooted in superstition was their public life wrapped up in fanatical bigotry. Dominion they rated above wealth, fame above welfare, conquest above all. A philosophical school was attempted in Rome in the time of Cato, the censor; but he, fearing that philosophical studies would effeminate the spirit of the young men, sternly dismissed it. Cato himself was not illiterate, for he wrote a celebrated treatise upon agriculture, and was acquainted with the Pythagorean tenets.

Lucullus, while he was questor in Macedonia, and afterwards, when he had the conduct of the Mithridatic war, had frequent opportunities to converse with Grecian philosophers, whence he acquired such a relish for philosophical studies that afterwards, returned to Rome, he made a large collection of valuable books and erected a library, with galleries and schools adjoining. This place became the daily resort for men of letters, where every one enjoyed the benefit of reading or conversation, as best suited to his taste. At a little later period M. Terrentius Varro wrote a work touching upon natural history, "De Re Rustica" on agriculture.

In the year B.C. 106 was born Marcus Tullius Cicero at Arpinum. This illustrious Roman, who eclipsed all his contemporaries in eloquence, has also acquired no small share of reputation as a philosopher. His eventful and meritorious life has been as much praised and admired as his tragic end has been deplored and lamented. He addicted himself to the principles of the middle academy, a branch of the old academy, or strictly Platonic school. In his treatise, "De Natura Deorum"—on the nature of the gods—and "Questiones Tuscu-

lanæ"—Tusculan researches—he effected a complete overthrow of the Olympian gods, exposing the unworthiness of such conceptions of divine nature. Of his philosophic works, "Hortensius," which did not come down to us, the celebrated ecclesiastic writer, Augustine, confesses that the study of this work was to him a powerful stimulus to the pursuit of wisdom. Equally aggressive against the ancient faith is the didactic poem, "De Rerum Natura"—on the nature of things—by Titus Lucretius Carus. He was born in the year B.C. 99. Very little is known about his private life, which he seems to have passed remote from the tumults of the civil war. He was an Epicurean, and his great poem, which he dedicated to his friend, the poet Memmius, conferred, more than any other writing, at the restoration of the sciences and toward the revival, illustration, and rehabilitation of the doctrines of Epicurus. By this time all the old schools of Greek philosophy were well represented in Rome, and we see that, as Alexandria had sapped Athens, thus Rome was now sapping Alexandria. Public patronage was divided between the Stoic and Epicurean tenets, the latter becoming prevalent under the rule of Augustus. All the gay and mirthful intellects of the poetical circle attached to the person of Mæcenas, and assembling at the jovial Court of Augustus, were followers of Epicurus. According to Epicurus' doctrine, happiness is the highest object and good of life. This happiness was referred to the soul as an inseparable element of the body. As a natural consequence of this opinion, exploration and observation were held to be the main object of philosophy. The vitality of the scientific germ was thus preserved, although it remained dormant for ages to come.

The Stoics held purity of morals, self-control, and contempt of sensual pleasure for the main object of life. In the times of adversities the Stoics proved themselves true to their principles. When under the reign of Tiberius and Nero, every kind of abomination was practiced openly, and every enjoyment of life became poisoned with fear and shame, the Epicureans retired. The Stoics alone fought the battle against vice and oppression, and fell victims with unshaken fortitude, like Seneca and hundreds of Christians.

Augustus himself was a patron of literature and science. Many persons of the highest distinction in Rome were the same way inclined, and during his reign so generally prevalent was the study of philosophy that almost every statesman, lawyer, and man of letters was conversant with the writings of philosophers. The period of his reign, and of several of his successors, was distinguished in cultivated taste and elegant manners, going down to posterity as the Augustan age. That taste continued, even under those emperors who were more addicted to pleasure than to wisdom. Ultimately, in the process of time, in the Christian era it went under through the interminable theological strifes, and that monstrous production of monkish ignorance, the Scholastic philosophy.

The poetic and philosophic works issuing under the Augustan palladium, entirely lost sight of the progressive, because inductive procedure of Aristotelian investigation, reverting to Platonic and Epicurean sublimities, groping after the ideal, obscure, and unknowable, treating with contemptuous neglect those obvious realities out of which later generations were destined to construe a higher civilization. Many sublime but fruitless conjectures are avowed in the classics of that time. Thus Virgil, in the fourth Georgic, derives the origin of things, after the Stoics, from a divine principle pervading the whole mass of matter :

His quidam signis etque haec exempla secuti,  
Esse apibus partem divinae mentis, et haustus  
Aethereos dixere: Deum namque ire per omnes  
Terresque, tractusque maris, coelumque profundum.  
Hinc pecudes, armenta, viros, genus omne ferarum,  
Quemque sibi tenues nascentem accessere vitas.  
Scilicet huc reddi deinde, ac resoluta, referri  
Omnia, nec morti esse locum, sed viva volare.  
Sideris in numerum atque alto succedere coelo.

—IV. Georgica (Virgil).

Led by such wonders, sages have opined  
That bees have a portion of a heavenly mind;  
That God pervades, and, like one common soul,  
Fills, feeds, and animates the world's great whole;  
That flocks, herds, beasts, and men from him receive  
Their vital breath; in him all move and live;

That souls discerpt from him shall never die,  
 But back resolved to God and heaven shall fly,  
 And live forever in the starry sky. —I. Warton.

In another place the poet introduces Anchyses philosophizing upon the same principles :

Principio coelum, ac terras, camposque liquentes  
 Lucentemque globum lunae, Titaniaque astra,  
 Spiritus intus alit, totamque infusa per artus  
 Mens agitat molem, et magno se corpore miscet.  
 Aen. VI., V. 724.

Know first a spirit with an active flame  
 Pervades and animates the mighty frame,  
 Runs through the watery worlds, the fields of air,  
 The pondrous earth, the depths of heaven, and there  
 Glows in the sun and moon, and burns in every star.  
 Thus mingling with the mass, the general soul  
 Lives in the parts and agitates the whole. —Pitt.

In another beautiful verse he gives utterance to the Stoical mood, in honor of Lucretius :

Felix qui potuit rerum cognoscere causas  
 Atque metus omnes et irrevocabile fatum  
 Subjicit pedibus, strepitumque Acherontis avari!  
 —Georg. II., v. v. 490.

Happy the man whose vigorous soul can pierce  
 Through the formation of this universe,  
 Who nobly dares despise, with a soul sedate,  
 The din of Acheron and vulgar fears and fate. —I. Warton.

Of the three greatest poets of this era, Virgil alone, in his "Georgica," occupies himself with the processes of organic nature. Ovid, in his "Metamorphoses," in the touching idyl, "Philemon and Baucis," expresses the belief of the ancients about the divine government of the world, as subject to the unrestrained discretion or pleasure of the gods in exact opposition to the modern idea of causation :

Immense est finemque potentia coeli  
 Non habet, et quidquid superi voluere peract est.

Immense and unlimited is the power of the gods;  
 And whatever be their wishes, perfected it is.

Agriculture was the only one of the exact sciences which the Romans cultivated with fondness and success. Since ancient times it had been well attended to in Italy and Sicily. Cato the Older had excelled as an agricultural author. Columella, who lived in the time of Nero, spent his literary talent for the revival of love of husbandry; Terentius Varro laid down the rules for pruning grapevines; Cornelius Celsus flourished as a celebrated physician and botanist.

The influence of nature upon the intellectual life of man seems to have been first conceived by Plinius the Older, who, stimulated by this idea, resolved to compose a work which should give an account of all objects of nature which had heretofore become known. This remarkable man enjoyed the esteem and friendship of Trajan, to whom he was an advisor in affairs of State. He gave his work the title: "Historia Naturalis." As it is not strictly systematic it should be called an Encyclopedia. Such works issue now from associations only of scientists, but Plinius undertook the gigantic task upon his personal erudition and resources, extracted from the works of not less than 2,500 publications of preceding or contemporaneous authors. In style and depth of research, it is vastly inferior to the Aristotelian work, which it was intended to supersede. The Grecian being equally great in inventing and observing, comparing all things critically, thoughtfully penetrating, giving new forms; the Roman, collecting with indefatigable zeal and industry, but void of individual judgment and personal observation, neither a critic nor a specialist. The botanical part of the book is the best conducted because he took Dioscorides for his guide.

The work happily escaped the ravages of the times, and became for the Middle Ages the foundation for the study of the natural sciences. In behalf of the service it rendered to the contemporaries it is entitled to the credit to have, by methodic exposition, raised natural science to the dignity of philosophy.

Taking up again the thread of history in Africa, we are translated to a period when the Christian religion had made great progress. A thorough ecclesiastic organization with seven bishoprics represented the secular power and dignity of the church.

Here we meet the ever memorable personage of Augustinus, the Bishop of Hippo. He was born at Tagaste, in Africa, A.D. 354: studied philosophy at Carthage and afterwards in Rome. Inclined to dissipation in his youth, he took on an active change of his mind after he had become conversant with the writings of Cicero. They had improved his taste and inspired him with an ardent love for wisdom. Not meeting with the satisfaction he expected from the Greek and Roman writers, he applied himself to the study of the holy Scriptures. While in Rome he undertook the profession of rhetoric. From this engagement and his skeptical turn he became involved in irksome controversies, to evade which he moved to Milan. While there, and before his return to his native land, to accept the Bishopric of Hippo, he gained the friendship of Ambrosius, Bishop of Milan, a Christian teacher of great eloquence and probity. In his works he shows great attachment to the Platonic system, and in one chapter of the book, "De Civitate Dei," (The City of God), he treats natural theology in the manner of Plato. He is inclined to think that all objects, besides animals, are in some way endowed with souls, and advances the idea of a possible spontaneous generation, as he could not otherwise explain the existence of animal life upon oceanic islands, far removed from the continents. He proposed that from the beginning of the world two kinds of seeds of the living beings had existed: one, the visible, which the Creator had implanted in animals and plants; that each, after his own manner, should propagate itself; the other, an invisible one, which lies latent in all elements, and becomes active only by particular proportions of mixture of matter and degrees of temperature. This seed, lying latent in the elements, since primordial times, he thought would produce plants and animals in great multitudes without the coöperation of preëxisting organisms. He did not controvert the privilege of explaining a natural process in an intelligible way. The orthodoxy of the present day would not allow him to raise such a conflict with the Mosaic narration. He is the most learned, and permanently, the most influential of the ancient fathers of the church. His firm belief in the reality of miracles, his definite declaration that he would prefer a mira-

cle to logical proof in an argument, has been, on account of his authority with the faithful, a serious obstacle to the scientific investigations of the truth. His writings mark the turning point in the transformation of the classical philosophical style into the mystic theologic dogmas and hierarchic aspirations of the fifth century. The minds of the people in the Western Empire, as well as in the Eastern Empire, had become so generally and so profoundly occupied with metaphysical mysticism, and depraved through the fearful social corruption resulting from it, that the love of knowledge fell into disregard and repudiation, and was declared nefarious.

Augustinus died during the siege, and only two days before the storming of Hippo by the Vandals, in the year 430.

The Vandals, a half-breed of Germanic and Sarmatic blood, had, during the migration of the nations, overrun Spain, and invaded from there the Roman province of Africa. Of all the Germanic tribes they were the most cruel and savage, and their character had been little, or not at all, improved with their adoption of the Christian faith. In 429 they had crossed the straits of Gibraltar under their leader, Geiserich. After a fearful despoliation, lasting about one hundred years, their dominion came to an end through an annihilating defeat, which they sustained at the hand of Belizarius, whom Emperor Justinian had intrusted with the command of a large army. Africa was now annexed to the Byzantine empire, until fate soon again delivered it into other hands.

In the preceding chapters we left Alexandria silenced by the scymetar, and dismantled, and thus the patriarchate of that city ceased to have any further political influence in the Christian system. In little more than one generation the whole of Northern Africa was converted and speaking Arabic.

With the rapidity of a storm advanced the forces of Omar. After Syria, Jerusalem, and Egypt had fallen into his hands he determined to advance upon the Roman province of Africa. His successor, Khalifa Abd-Almalik, completed the conquest, intrusting his tried general, Emir Musa, with the conduct of the campaign. Musa completely subjugated the Barbers and retired to the capital of his own province, Kairawan, trans-

ferring the command in the extreme west upon the trusted general, Tarik.

Having completed the conquest of the entire East, from the Ganges to the Nile, and now of Africa, the Moslems, now known under the name of Saracens, bethought themselves to invade and convert to the Islam the reign of the Visigoths in Spain.

The Khalifs had abandoned, ere this, the evil policy of opposing science. They very soon became distinguished patrons of learning. It became customary for the first dignitaries of State to be held by men distinguished for their erudition. Under the Khalifs of Bagdad this principle was thoroughly carried out. The cultivators of mathematics, astronomy, medicine, and general literature abounded in the court of Almansor, who invited all philosophers, offering them his protection, whatever their religious opinion might be. His successor, Al-Rashid, issued an edict that no mosque should be built unless there was a school attached to it. The schools of Alexandria flourished again under complete religious equality.

After the fall of Ceuta, the Visigothic outpost in Africa, Tarik crossed the straits and took a fortified position with his army on a mountain, afterwards named after him, Gabel al Tarik, Gibraltar.

After the decisive victory in the battle of Xerres de la Fontera, won by Musa, over the king of Goths, Roderic, who in this calamity lost his life, the conquerors lost no time in occupying the entire peninsula.

Only the northern mountainous provinces of Galicia, Asturia, and Biscaya, maintained their independence. The Gothic princely families had retreated into inaccessible mountain fastnesses. Unapproachable in front, they were secure in their rear, as they stood in friendly relations to the neighboring Franks. From this asylum grew forth, at a later period, a new Christian Spanish empire. Spain was now a part of the great Moslem empire, whose Khalifs resided in Bagdad, and later in Damascus. The provinces were governed by Satraps, appointed by the Khalifs, with the title of Emirs.

The absolute freedom granted to all professions brought

about in a very short time a conflux of enterprising people and rapid growth of industries, trade, and science. After the lapse of two hundred years, during the reign of Abd-Errahman III. (912-961), Spain had become the most prosperous empire, with a population of 30,000,000, emulating Rome in the Augustan time. Abd-Errahman was the first Spanish Omajade who declared himself independent from the Oriental Khalifat. From authentic documents we are informed that there existed seventy large libraries and seventeen great schools, provided with liberal endowments, elegantly furnished in palatial buildings. Students from distant Anglia, Germany, and France flocked to the celebrated universities of Cordova, which numbered one million inhabitants; to Toledo, Granada, and Sevilla to listen to the lectures of Averrhoes, of Cordova, the chief commentator of Aristotle; Albucasis, the surgeon; Alhazen, the astronomer, who discovered the refraction of the atmosphere; Almaimon, who determined with nearly complete accuracy the obliquity of the ecliptic; Ben Musa, who introduced the Indian numerals and invented the common method of solving the quadratic equations. The works of Aristotle, Theophrastus, and Dioscorides were translated and taught in the schools.

Alhazen was the first to correct the Greek misconception as to the nature of vision; determined the retina as the seat of sight, and showed that the impression was carried by the optic nerve to the brains. Many instances in physics are not better explained nowadays than they were by him. The materia medica was expounded in well-arranged pharmacopœias. No branch of art or science known at this period was neglected, and advancement loomed up in the theoretical field as well as the practical. This effulgent radiancy, however, found its counterpoint in the dark shadow of extravagant luxury, effeminating sensuality weakening the national valor. Wisdom and mental acumen sunk to scholastic flippery; fatuous speculations and that trifling witticism to which the Arab, by national propensity and a spirit of language, is much addicted, and which found abundant fuel in the now prevailing religious discussions.

The eastern Khalifat had already fallen into a tottering atti-

tude through the division into the sects of Sunnites and Shiites, which had been formed into violent political factions. The Spanish Khalifs had been repeatedly overtaken by serious disasters by their attempt to spread the Islam across the Pyrenees. Their defeat at Tour by the united forces of the Franks, under Karl Martell, terminated forever their advance northward (October, 732).

The Goths, who had preserved their ancient valor, now descended from their mountain fastnesses, harassing the hereditary foe with unceasing raids, taking advantage of the internal feuds in the disorganized and weakened Sarcen dominions. One by one fell the open or fortified cities into the hands of the kings of Castile and Aragone, who gave the defeated the choice to either submit to forced conversion or to be burned at the stake, by order of the Holy Inquisition.

In place of the toleration and equal rights before the law for all nationalities and confessions granted three hundred years ago by the conquering Saracens, the Spaniard now institutes the Inquisition, and as we will hereafter see, becomes, at a later day, the merciless despoiler and executioner of two other civilizations in the newly discovered Western Hemisphere. It is meet here to speak of this hellish institution, which more than any other wickedness obstructed progress and overwhelmed the best of men for their devotion to reason and truth with ruin or cruel death. The device originated in the plan to increase to an unlimited extent the power and wealth of the church and its adherents. A papal bull, issued under papal seal by Pope Innocence III., Anno 1193, gives to Peter of Castelnan instructions to summon before a tribunal, called "The Holy Inquisition," all persons accused of holding or divulging heretical doctrines or opinions not in conformity with the doctrines of the orthodox Roman Catholic Church, with unrestricted jurisdiction.

This mandate of the Holy Father was so successfully carried into effect that in Madrid alone—other places also designated for the execution not included—within three hundred years, as attested by documentary history, 300,000 persons were cremated at the stake for religious opinion's sake. These

public executions were great festivals for this noble nation and were called "Auto da fe"—act of faith.

Under the pressure of this fearful hierarchical demoralization originated the frantic efforts for the conquest of the holy land. With the sacrifice of millions of lives a momentary success had been purchased, to end directly in a complete failure. The progress of the fourth crusade gives a vivid picture of the state of barbarism in the Western States, and the character of the Roman Church at that time. The campaign was ostensibly planned by Pope Innocence IV., but afterwards insidiously diverted through the connivance of the Venetian Republic, and the Roman curia against Constantinople, the seat of the Eastern Church, and the rival Byzantine Bishop or Patriarch.

The superior physical strength of only 20,000 attacking Franks overwhelmed a city which at that time had yet 400,000 inhabitants. Few lives only were lost by the combatants, but the greatest part of the city was laid in ashes, and many of the inhabitants afterwards slain or brutally mistreated, and the devastation and ruin from the treatment of their Christian combatants (1204) was in no degree less severe than what happened two hundred and fifty years later, after the ultimate downfall of the Byzantine empire and sack of Constantinople by the Turks.

Rome had accomplished its design. The Bishops of Rome at last appointed the Bishop of Constantinople. The acknowledgment of papal supremacy was complete. The holy relics were carried away to raise to greater holiness the cathedrals of the Western barbarians.

An inventory of the spoils carried away by Abbott Martin for his monastery in Elsass illustrates the low moral character and superstition of the Christian world at that period. It enumerates the following priceless articles: (1) A spot of the blood of our Savior, (2) a piece of the true cross, (3) the arm of the apostle James, (4) part of the skeleton of John the Baptist, and (5) a bottle of the milk of the mother of God. Works of art in precious metals or bronze were melted into coin and thousands of manuscripts were burned. From that time the works of many ancient authors disappeared forever.

Before bringing to a conclusion the history of the gradual collapse of the Byzantine empire, and its extinction through the second conquest of Constantinople by Asiatic barbarians, it will be well to recall the principal data of the fate of the Western empire, and what little there can be said about the intellectual state in that time.

Constantine the Great had on his deathbed, A.D. 33, divided the empire into two halves between his sons. Byzantium had already put on the name of New Rome, City of Constantine; finally, Constantinople; and had taken on customs and manners of Oriental character, having little semblance to Roman habits; Oriental servility and sycophancy the tone of court life.

After Emperor Justinian had reconquered Africa from the Vandals he turned his forces against the Goths, who held Italy, where his general, Belizarius, captured Rome, December, 556. The operation closed with the surrender of Ravenna, 493. Under the reign of the Ostro-Gothic king, Theodoric, two remarkable men were his ministers, Boetius, the philosopher, and Cassiodorus, the theologian. The latter, being completely imbued with the doctrines and principles of Augustinus, the Bishop of Hippo, introduced an educational system which totally ignored the classical philosophical style of teaching. Heaven, he says, is to be the terminus of man's earthly wanderings; abandonment of worldly interests, and the surrender of personal convictions to the doctrines and commandments of the church, the sure path to his supreme blessing. The schools were graded into two courses: the Trivium, or lower class, instructed in grammar, rhetoric, and dialectic; the upper course, or Quadrivium, was occupied with the teaching of arithmetic, geometry, astronomy, and music. He pays some tribute to the natural sciences only in aid to agriculture and horticulture, but omits them altogether in the course of education.

This system remained in vogue under the monastic rule throughout the Middle Ages. Unremitting scholastic and sophistic strife about theological whims and trifles, bloody contests, and cruel persecutions for opinion's sake, fill henceforth, under the unbroken dominion of the church, the annals

of the Western church, until the violent struggles of the reformation admitted some rays of spiritual freedom, breaking asunder the dark clouds of intellectual subjugation, brightening once more and bringing to life the blasted fields.

In a period when religious systems had lost all ethical sanctioning, when all sciences and civil order had been drowned in blood, when fratricide, poisoning, and assassination were the regular methods and instruments of governments, hierarchy and a faith without intellect must necessarily supervene, can even be beneficial to maintain some kind of cohesion of society, until unforeseen events coöperate to bring about a new era; but if the hierarchical state becomes permanent, such a system is sure to fall into degeneracy.

The student of history turns over many a page with a shudder and a sigh. None are more painful and distressing than the ones now passing before him, when darkness is so complete and general without the glimmer of one single star to point out an opening or rent in the overcast clouds.

History becomes then only interesting, instructing, and fascinating when there is progress. To give a pleasing account of the Byzantine, Turkish, or Chinese history would baffle or distract the ingenuity of a Thucydides.

A wandering tribe of Asiatic nomads had adopted the faith of Mohammed. A branch of them, the Seldshuk Turks, had, a century ago, overthrown the Persian Empire. After this they defeated the Greeks and drove them out of Asia Minor. After those successes they designed the conquest of the Byzantine Empire. Their Sultan, Soliman, had crossed the Hellespont, captured and fortified Gallipoli, thus securing a foothold in Europe, and a base for future operations. From this time on the tottering empire lay in an agony. Its doom was apparent.

The emperor, John Palæologus, went to Rome, prostrated himself at the feet of Urban V., the Roman pontiff, renounced his heresy respecting the supremacy of the Roman pontiff and the double procession of the Holy Ghost, and kissing the feet of the Holy Father, besieged him for help. The successor of Constantine the Great had given up his religion, but he received no equivalent reward. The pontificate had no power

of his own, and could not or would not influence the western or northern powers to take up the defense of a sinking empire.

At last the inevitable asserted itself. On May 29, 1453, the assault was delivered. Constantine Palæologus, the last of the Roman emperors, fell, as it became a Roman emperor, in the ditch. With his death resistance ceased, and the victorious Turk rushed into the city, whose citizens to the last moment expected that an angel of the Lord, with a sword in his hand, would descend from heaven and save the city of the Lord.

There was no longer any need for reconciliation between Latin and Greek Christianity—the sword of Mohammed had settled their dispute.

Soliman the Magnificent was ruler over all Macedonia, took Belgerad in 1520, and beleaguered Vienna in 1529, but the German valor stayed his advance.

These events may be considered as the tragic end of an age bound in its conception on false logic, and ill conceived faith in wonders and ecclesiastic infallibility.

Encouraged by the success of three commercial enterprises, the revival of art and letters in Italy, a spirit of critical thought emerges.

Within a short space of time the true configuration of the earth was definitely demonstrated by the three great voyages, the discovery of America by Columbus, the doubling of the cape by Vasco de Gamma, and the Magellan circumnavigation of the earth. Progress came again, gradual, but assured of continuance, when the spirit of a new era first dawned in Italy in the fourteenth century. To Dante, Petrarca, and Bocaccio, Europe not only owes the creation of a new modern national literature, but also the revival of classical studies, of Greek and Roman letters.

During the fifteenth century arise again from their lethargy arts and sciences in Italy, one by one, and toward the end of it botany too attains a resurrection. John Argyropolus, a noble Byzantine, who arrived in Italy a refugee, after the destruction of his home by the Turks, and having lost all but his liberty and learning, by papal order translated the writings of Theophrastus from the Greek into Latin. The works of

Dioscorides and Plinius were brought up from the dust of oblivion and put in circulation among the literary world by the aid of the recently discovered art of printing.

Soon it becomes evident that to understand the botanical books the knowledge of the ancient languages alone was not sufficient, and that one had to be conversant with the objects themselves which were treated of in these writings. Now, at last, turned the scholars of Italy (which in every science and art was far in advance of the rest of Europe) with great fervor to the observation of nature, that they might find the plants with which the ancients were occupied.

Reuchlin and Erasmus had, meantime, north of the Alps, kindled the torch of classical learning, which was soon to blaze up into the purifying flame of the reformation. The movement soon extended to the Netherlands, and over Germany. The most prominent, indeed, of the fathers of botany in the sixteenth century, who, in careful observation and description of the native plants, rank foremost, had their homes in that memorable corner, the southwestern plain, through which flows the upper course of the Rhine, where also stands the cradle of the art of printing, and where a lively intercourse was cultivated between the ancient towns of Frankfurt, Mainz, and Strassburg.

Botany, however, as cultivated by these men was not the free and independent science of Aristotle. It was once for all the helpmate of philosophy and medicine, for the only problem which they tried to solve was to find again the plants of which Theophrastus, Plinius, and Dioscorides had spoken, and to discover the virtues which, according to ancient superstitions, are thought to be inherent in every plant, either beneficial or injurious to man. Nevertheless the morning had dawned, the day grew lighter, and the scientific thought, which had been captive in the gloomy monasteries during mediæval times, moved about again amongst thinking people, in the open daylight.

Since that time botany continued, uninterruptedly, to develop, although the solution of the problems with which she was occupied were, at different times, diversely attempted,

for, as Goethe remarks: "The further that knowledge extends, the more questions come in evidence."

The fathers of the modern botany held the naïve opinion that the plants of Greece and Anatolia could all be found in their northern fields and forests. Yet, a closer search of their regions soon cleared up this mistake, and when in that period of the great geographical discoveries the newly acquired territories were explored, it became manifest "how unequally is woven the carpet with which vegetation clothes the naked earth," and that there were vastly more plants than what were known to Plinius and Dioscorides. The number of plants recognized as distinguished kinds increased so rapidly that even the most favored memory could not encompass all. The old names were not sufficient, and new ones had to be invented. Authors strove to make the descriptions as plain as possible, and the illustrations were, after the early example of the Greeks, inserted into the text, as true to nature as the newly invented art of wood engraving could accomplish. Soon the necessity of an orderly arrangement to facilitate identification became imperative. Such a repertory is called a system, and from that time it appeared to be the principal problem of botany to find a system by the aid of which a survey of the vegetable kingdom would be rendered easy, and the proper name of an unknown plant be found with the least effort.

Not before the middle of the last century appeared that analytic mind who would teach men to find the way through the immeasurable plenitude of plants, and likewise animals—Linné, who, far ahead of his time, gifted with eminent power of conception, grasped and perfected a perspicuous plan of arranging all terrestrial objects into classes, orders, genera, and species. He carried botanists through a severe but wholesome schooling, training them to fix their eyes upon plants attentively, to dissect and compare them. He is likewise the author of an admirable scientific language (terminology), which provides for every difference of plant form an exact and intelligible term.

In that way more than in any other, Linné excelled his predecessors, when he perceived that the utility of a system

of plants would reach beyond its practical usefulness. He desired to establish still another system, which would group together those plants which resemble another the most, or which are, as he explained himself, the nearest related. Such a system he declared to be the natural system, and the construction of such a one the highest and ultimate problem of botany. But the time and means for its accomplishment were not at Linné's disposition. It was reserved for a more genial clime, and a people endowed with taste in horticulture, to develop this idea.

Bernard Jussieu, then director of the Jardine des Plantes in Paris, had designed a system arranged on affinity, according to the natural relationships, based upon investigations made in the garden of Trianone, near Versailles, which belonged to Madam Pompadour, a friend and patron of science.

His nephew, Antoine Laurent de Jussieu, a man of very impressive and imaginative mind, and profound learning, soon after became the author of the natural system. This systematic tendency which seeks its principal object in the description and arrangement of plants, while it increased immensely our knowledge of the forms of plants, yet while thus occupied with the external differences, lost sight of those qualities which constitute her a living organism. There is surely a fascinating charm in the aspect of the thousandfold mixture in the crowded mass of flowers, which is so well expressed in the confession of Jean Jacques Rousseau, "Tant que j'herborise, je ne suis pas malheureux;" and this attraction is not even absent in the dried plants of the herbaria. It is attributable to this fact, that such a one-sided tendency as the one followed so long a time by the old Linnæan school was kept up for many decades by a great number of practical botanists. Up to this day thrives, especially in England, the tribe of root diggers and herbalists over which already Theophrastus, two thousand years ago, made merry.

While thus amongst the followers of Linné the study of botany had become somehow encrusted, and apparently temporarily arrested, a rise had taken place long ago in England. The experimentative method had revived and animated the other natural sciences. Frances Bacon, the Lord

Chancellor of King James I., of England, presented to philosophers a new method of inquiry—"a new instrument," as he called it—the "Novum Organum," a philosophical treatise, an idea which Aristotle had not yet conceived, which led the way from discovery to discovery, and served to rejuvenate culture and progress. Bacon taught: "The natural philosopher ought not to confine himself to the observations of nature in just that state in which it happens to present itself to the observer. Results from such inquiries are ambiguous and confused. The inquirer must understand to put nature in such a condition that by rationally conducted examination no other but just, definite, and plain answers could be possible: he must combine experiment with observation." Like a seed dropped on congenial and well-prepared soil, Bacon's advice brought a gratifying harvest, and ever since experiment and observation go hand in hand by every scientific investigation.

The students of olden times often had to console themselves with the poor consolation:

Geheimnissvoll am lichten Tag  
 Last sich Natur des Schleiers nicht berauben,  
 Und was sie deinem Geist nicht offenbaren mag  
 Das zwingst du ihr nicht ab mit Hebeln nud mit Schrauben.  
 —Goethe (Faust).

Mysterious, even in the open day  
 Nature retains her veil, despite our clamors.  
 That which she doth not willingly display  
 Cannot be wrenched from her with levers, screws, and hammers.  
 —Faust.

The modern investigators have refuted this maxim; with the levers and the screws of their physical and chemical apparatus, the telescope, microscope, and spectroscope, they forced Nature to surrender her recondite secrets, one by one, which spontaneously she never would have revealed.

The new experimentative method came to be applied in the course of the seventeenth century for the investigation of the actions of inanimate nature, and for the laws of atmospheric and hydrostatic pressure, gravity, and light, and for the purpose of submitting them to mathematical calculations.

Toward the end of the century the same method was also resorted to for the investigation of animal life, and the discovery of the circulation of the blood was the first important result. In the eighteenth century, lastly, plants also undergo the trial of experiment, and the Englishman, Hales, was the first one to consider the vital action of plants as the result of the action of physical forces, and to determine them with weights and measure. He compares the force which propels the sap of the bleeding grapevine upward in the spring, to a column of mercury of a definite height, or with the pressure of the crural artery of the horse. He weighs the quantity of water which a pear tree or a sunflower absorbs from the soil in twenty-four hours; he sets forth in the year 1727 a static of vegetation which resolves the whole of vegetable life into a physical problem.

The Frenchman, Duhamel, published in 1758 a physical treatise on trees, wherein he investigates the laws by which the sap circulates in the wood and bark; and in the same year appeared a book on the functions of the leaves, by Bonnet, of Geneva, wherein he attempts to define the cause of the movement of leaves toward the light, and their transpiration.

In this way enters the physiology of plants, based upon physical science, into the rank of the exact sciences.

As soon as, toward the end of the eighteenth century, Chemistry awakes out of the obscure hallucinations of alchemistic dreams, we find her at once engaged in the service of botany. The Belgian, Ingenhauß, and the Englishman, Priestley, discovered the wonderful interaction between sunlight and terrestrial atmosphere, vegetable and animal life, demonstrating how the carbonic oxide, exhaled by animals, is inhaled by the plants, and inversely, that the oxygen which the plants emit under the influence of light is indispensable for the life of animals. Toward the end of the century Theodore Saussure, of Geneva, shows how, by the nutrition of plants, the moving force is supplied by the light and heat of the sun, carbonic oxide by the air, and water and ammonia by the soil; further, that the ashes of the plant are not accidental impurities, but indispensable elements, which the plants take up from the soil with their roots, and thereby lies the founda-

tion of our knowledge of the chemical nutrition of plants, which Justus Liebig has recently elaborated and made the basis of rational agriculture.

To the edifice of scientific botany, as far as we have followed it, contributed successfully all nations of Europe—Italians, Englishmen, Netherlanders, Swedes, and Frenchmen; the latter, since the time of Louis XIV., conspicuously so through works of great originality and importance. Germany, though, had to some degree since the reformation ceased to take part in the progressive development; not for deficiency of operators, but for want of individual creative ideas, they ranked second and third, treading in the footsteps of their foreign neighbors.

Last, during the reign of Frederick the Great, a turning point is reached. The national spirit announces itself in a vigorous onward push in novel paths. In science the flood begins to swell; higher and higher rises the wave of youthful vigor, and like in a seasonable spring, all trees, one after the other, become bedecked with flowers, thus likewise Germany experiences a rapid development in all sciences, in literature, music, and philosophy.

About the time of the seven-years' war, Casper Frédéric Wolff originated biology, or the science of life, by his microscopic researches, examining the development of animals from the egg, and of leaves and flowers in the bud. Koehler, Hedwig, and Conrad Sprengel disclosed, by clever experiments and observations, the secret of the fertilization of plants. In the nineteenth century scientific botany flourishes in Germany as it never did before, and it is especially by the agency of German students that botany now stands on an equal footing with the other sciences which formerly excelled it.

Should the new departure in modern botany be brought in connection with the name of any single man, no better one can be chosen than Goethe. He does not rank with scientists professionally considered, but nevertheless he was well versed in those disciplines. Although an accurate observer, reflection overreached observation and poetry the thought, until from the lovely flower of poetry matured the natural philoso-

phy. The reformatory idea which Goethe conceived in the view of living nature, is the idea of evolution. When in fact C. F. Wolff did prepare the way for the study of development, by the method of microscopic examinations, so likewise Goethe did initiate morphology, the exposition of the forms of plants and animals. Goethe sees the essence of life not in the perfected form, no matter how complicated the structure, nor in the mechanical efforts or fruition, which ever anew recurring, represent the play of life. He conceives every organism to be a process of development, beginning with the moment of the birth, and passing through a series of conditions to its final termination. The universe and the individual obey the same law, as Goethe gives it:

Es muss sich regen, schaffend handeln,  
 Nur scheinbar stehts Momente still;  
 Das Ewige regt sich fort in Allem,  
 Denn Alles muss in Nichts zerfallen,  
 Wenn es im Sein beharren will.

Even systematic botany has profited from morphological comparisons, which permitted it to draw its ideas from profounder sources, and to adduce a rational interpretation of the genesis of the organs to the mere description of external forms.

Since Alexander Von Humboldt, animated by the charm and grandeur of the impressions which he had received on his journeys, had raised the geography of plants to the dignity of a science, it has become clear that there exists an intimate connection of species, genera, and families of plants, with the conformation of the surface of the planet, and the conditions of soil and climate.

Let it begin to stir, give birth,  
 Take shape first, then convert.  
 Seemingly for moments stands it still;  
 Eternal motion is eternal's zeal.  
 Be sure it will dissolve to naught  
 If to stand still it be brought.

More fruit bearing than any are the ideas connected with the evolutionary doctrines of Darwin, which explain how the in-

numerable forms of plants ought to be considered as one uninterrupted series of development, which begins with the first dawn of life, and remodels form and structure of plants in ever-increasing perfection, and not as accidental and isolated individuals.

Unger, and others have even conclusively proven that the history of their ancestors, which lie buried in the rocks of past epochs, has to be considered, if the present distribution of plants would be comprehended.

Goethe had followed up the development of the plants to the germ, but the starting point at which his examinations begin, the radicle descends into the soil and presents its cotyledons the moment when the germ breaks through its envelopes and to the light, this is not the real beginning of vegetable development. The question remains: How comes the germ into existence?

The unaided eye does not suffice, nor the simple magnifying glass, which alone was at the disposal of the botanists of the Linnæan time. The compound microscope had to come to the aid of the botanist.

The invention of the microscope gave the same impulse to the study of objects of the smallest dimensions, as did the telescope for the view of the infinite expanse of the firmament. Without knowledge of each other, and fully independent, two scientists, Marcello Malpighi, of Bologne, and Nehemias Grew, of London, put before themselves the task to examine microscopically the internal structure of plants. On December 29, 1671, happened the memorable incident that both these men presented simultaneously to the Royal Society of Arts in London the results of their researches. This day, therefore, must be called the birthday of microscopical anatomy of plants.

From this date we know that plants are not made up of flesh and blood, nerves and veins, as Theophrastus had fancied, but throughout from small, vesicle-like particles, which, on account of their resemblance to cells of the honeycomb, received the name "Vegetable Cell." The importance of this discovery failed at this time to be duly appreciated and utilized, and had a century afterwards nearly fallen into oblivion.

Again, at the beginning of the nineteenth century, a new impulse takes hold in this direction, and the microscope was now applied with more painstaking and circumspection. The instrument, too, had been, about 1830, greatly improved and made available for the solution of problems of structure and growth.

The origin of the germ or embryo was the first object of inquiry which found its solution in the discovery that every plant, be it palm or oak, or a humble grass, is originally a simple microscopical cell, which comes into existence in the interior of the germ, through the agency of a generative act. That was a highly important discovery, for the origin of a new living being must be considered a new creation. Now it was apparent that the secret of that creation consists in the formation of a cell. After this followed the second problem: How develops out of this first cell the complicated plant, with the manifold organs, each again composed of innumerable cells? The microscope again served to illustrate the process: the contact of the fertilizing pollen causes this cell to form a partition through its middle, dividing it into two chambers. Each chamber represents an independent cell, and each of these soon subdivides itself again, and by this same process, continually repeated, comes about the many-chambered and many-celled structures, which we call the plant.

Analogous to the rearing of a house in accordance with the design which prescribes the position of the stones and walls, follows the process of cell after cell in obedience to an innate plan which differs in every species, and descends by inheritance from generation to generation.

The larger flowering plants were naturally the first objects submitted to these investigations, but it was soon found out that the less conspicuous and simpler plants, commonly comprised under the name "Cryptogames"—i. e., mosses, seaweeds, lichens, and fungi—afford a far richer field to the observer. The simpler the plant, the more incomplete its organs; the less is also the number of cells composing it, and the better the chance to survey the structure and development. Many surprising processes accompany the growth of the lowest. Here only we meet with those curious germ cells, which, like

infusories, swarm about in the water with rapid motions. Here we find invisible corpuscles, or threads endowed with distinct sexual properties, and an incredible variety of propagation, and such astonishing metamorphoses, as to make the same individual at different periods of his life appear totally different.

It is hardly possible for those who are not connected with such investigations to conceive the charm by which an inconspicuous little plant fastens the observer for hours, days, nay, even weeks, to the microscope, until he succeeds to close up a break in the process of development. No wonder that since half a century nearly all eminent botanists have been engaged in the study of the evolution of plants, and that the most important discoveries in plant physiology have been made, especially by German botanists, who conducted the most thoroughgoing microscopical investigations. Not the less in esteem are held abroad contributions from German biological laboratories, and it is very pleasurable to recount the foremost workers whose works are amongst the greatest creations of German science.

Foremost Schleiden initiated the profounder research by his analysis of the origin of cells in general, and of the germs in particular, in the year 1838. He was followed by Hugo Mohl, of Tübingen; Alexander Braun, of Berlin; Wilhelm Hoffmeister, of Heidelberg; Hanstein, of Bonn; De Bary in Strassburg, and Sachs in Würzburg, all of them now defunct. Among the living are Nægeli in Munich, and Pringsheim in Berlin. Under the direction of these eminent men have, within the last forty years, nearly all German universities established public botanical laboratories and physiological institutes, whereby a school of younger scientists was brought up, who elaborated thus continuously and successfully, that there is presently hardly any one important plant on which not the chain of development had link for link been joined together to a closed ring.

Furthermore had, during the same time, with equal and unabated zeal, the investigation of the development of the animal world been carried on, and we are now in a manner enabled to trace the evolution of the whole animated world, from

the simple plant upward, to the highest being, man himself, and to fathom the great plan of life by comparison of relations and differentiations.

But the services which the microscope had rendered to scientific botany are not ended in detailing the development of plants; for the cells, whose form and growth the microscope had revealed, are not merely the building stones by whose superposition the body of the plant had been built up; each cell is also an individual living being. Yes, it is the main living principle in the plant. As far as the tree takes up its nutriment it is the cells of its roots which are saturated with the water, which, concealed, circulates in the soil; while the tops and branches exhale oxygen at the exposure of the sunlight, for it is the green cells of the leaves which absorb carbonic acid out of the atmosphere and through the stimulus of light waves convert it into chlorophyll, starch, and other substances, and again emit the oxygen into the air.

Pending their growth, it is the cells which, stretching and swelling in consequence of the absorption of nutritive fluid, give rise to their multiplication in definite directions for the formation of new organs.

Should disease attack the plant, the cause lies in the cells, which were disturbed in their normal functions; and if ultimately the plant dies, the extinction of life starts from the cells.

After all the improvements of the methods with which the experimentative physiology had been advanced, and the relation of plant life to light, heat, gravitation, electricity, and chemical affinities had been so much clearer defined, as it was possible to do a hundred years ago, there never was left out of sight the importance of referring it to the life of the cell.

Moreover, it has been Schwann who, in the year 1838, clearly demonstrated that also the course of evolution of every animal, and even of man, begins with a simple cell; that all organs of animals are composed of cells, and proceeding from the division of the first cell. Further, that the animal cell is of the same structure with the vegetable cell; there is but one cell and one life.

The same way that the mathematician uses to find the value of an unknown quantity by the way of a simple equation, on

the same method investigates the scientist the occult laws of life by comparison of the simplest functions of the cells. Thus succeeded the genial Virchow to construct a system of pathology upon the presence of diseased cells.

A very great interest attaches to the recent investigations about fungi. Problems of surpassing importance, the solution of which the whole civilized world is eagerly awaiting, are thereby involved. Rust, blight, and mildews have from time immemorial ruined the crops. During the last quarter of a century nearly all cultivated plants have been visited by epidemics, which commenced locally, here and there, and were unheeded, and then spread themselves at once over whole countries, leaving failure of crops and famine in their train. A terrible plague has been the potato disease since 1845, and the diseases of the grapevines since 1848. Even the insects, from the common fly to the silkworm and the forest-devouring caterpillars, are infected by plagues. The pebrine, or silkworm disease, worked great injury to the silk industry and threatened thereby to seriously affect the wealth of a nation.

We now know that all these epidemics are caused by microscopic fungi, and spread by the dispersion of their spores, which communicate from plant to plant, and from insect to insect, the germ of a fatal disease.

After these facts had been satisfactorily established the question necessarily came up, whether or not these insidious plagues which, traveling from land to land, to remain here and there for a while, and then to disappear, to return again probably after a short interval, such as cholera, typhus, smallpox, scarlatina, and epidemic diseases of domestic animals, were also brought about by the presence of microscopic fungi?

Up to this day we have actually learned that such is the case in diphtheria, scarlatina, Oriental plague, cholera, intermittent and relapsing fever, yellow fever, and tuberculosis, and in hospital gangrene, smallpox, septicæmia, and even some other non-epidemic diseases.

Knowing now the nature of the invisible enemy, we may hope to devise means to keep off the enemy, or to avert its ravages.

In former times there had been an intimate connection be-

tween botany and the healing art. The former was expected to provide the most potent drugs, and received in return encouragement of its scientific endeavors. This kind of relationship is presently very unimportant since most of the medicinal plants have been eliminated from the *materia medica*, or are merely obscurely known as domestic remedies.

Investigation of the disease creating fungi makes up the tie, hereafter setting up new problems for both sciences which cannot be solved advantageously to the benefit of mankind except with mutual aid and coöperation. Modern agriculture and forestry are likewise intimately connected with botany. The former seeks to understand the conditions in which plants have to be placed in order to produce the largest returns; the other depends on information of a sanatory nature, or questions concerning the health of forest trees, and the means of averting noxious influences which threaten them with disease and premature decay.

In this way it has come about that botany is no longer confined within the narrow limits of its former territory. Applied to the highest problems of the natural sciences, it is an important element of national culture. We have received and still further expect from it explanations relative to the profound questions concerning life: What is life? What is death? Is there a specific vital power which ever remains the same, immutably indestructible, although the individual may perish? Is life possibly merely a phenomenon of the motion of matter, and equivalent of other forces—light, heat, gravity, chemical affinity—and, under the law of correlation of energy, transmutable into other modes of motion, and proceeding from them? By which process and in what manner has life taken its origin upon earth? How did it receive shape and expression in the innumerable forms of animals and plants? How did the long intervals of the different geological periods affect it? Finally, are the highest expressions and functions of life—consciousness, sensation, volition, imagination, reflection—operations of a separate cause, or only modifications of life itself, phenomena traceable down to their obscure beginnings, nay, even to the cells of the plants?

Space does not allow to dilate on this subject, but I may

mention in the line of physiological researches the discoveries of Bohumel Nemeč and G. Haberlandt in respect to geotropism—that is, the faculty of directing the growth of the roots in the direction of the earth's axis.

This phenomenon had always been accepted as a simple fact of nature, without any inquiry into the directing cause of this movement.

Physiologists had some time ago established the nature of the function of the delicate hairs and the otoliths in the semi-circular canals and ampullæ of the vertebrates, including man, to be organs of equilibration and localization; they had also found that the so-called auditory cells on the extremities of insects and of crustacea, which are of a similar structure, subserves the same purpose. It is the act of pressure by gravity of these otoliths, now called statoliths, upon those fine hairs, which excites the living protoplasm in these cells to effect functions, resulting in motions by which animals become sensitive of disturbances in their normal position in relation to normal or desired direction of their bodies, in relation to gravity, and try to correct them. By a chain of observations have the above observers determined that an analogous apparatus also subserves the geotropical and heliotropical movements of plants.

Specialized amyloceous granules in the tips of the roots, suspended in the protoplasm, and obeying the call of gravity, secure the centripetal movement. Likewise is it a statolith pressure in the internodes of the grassculm, which causes a swelling on one side of such a blade, and thereby a flexion or erection of the culm, when, for instance, the culm of wheat or stalk of corn had been prostrated by wind or rain.

Thus we have a very interesting elucidation of correlation of physical phenomena between plant and animal in the organic world.

It has been my intention to give a short review of the problems toward which botanists have been aiming, and at which they have, notwithstanding the changing demands of successive periods, sedulously working, closer and closer approached, ever since the time when twenty-two centuries ago

the genius of Aristotle and Theophrastus assigned to botany a special place in the domain of philosophy.

Last, but not least, it behooves us to devote a few lines to our own immediate interests. On our side of the Atlantic the science of botany developed on the same line of evolution as we observed it on the old continent. All energy was, as a matter of necessity, even in colonial times, directed to the differentiation and collection of species. Learned emigrants and scientific explorers from France, England, and Germany issued at home the first notices about American plants. Native-born citizens, otherwise employed in various vocations, as clergymen or physicians, soon followed, devoting their leisure time to collecting and describing the rich harvests gathered in their unexplored fields. These men were all either self-taught or had visited universities in Europe. Botanical training in public schools or colleges has been taken up only recently, and even within the memory of botanists yet living the courses in this science were limited, and broader inquiry considered not long ago as an object merely of recreation and relaxation. I know of reputable educational institutions of to-day which consider the instruction in natural sciences as a matter of polite accomplishment only, or fear a conflict with their religious sentiments. Fortunately for the progress of science men who, in the great strides of commerce and manufactures, have acquired great wealth, have seen that all the advances in their great enterprises have grown out of a succession of obscure discoveries, made by the devotees to pure science, which the discoverer himself estimated only as one step in unraveling the great mysteries of nature. Sooner or later the great business men adopted and applied their discoveries for the benefit of all men in the shrewd art of money-making. To these men, successful in business, we owe it to-day that institutions have been endowed for the propagation of knowledge, and, supplied with ample means, that some men are able to devote their entire time under most favorable conditions to scientific research.

All the greater universities in this country are now equipped with botanical or biological laboratories, in which much independent research is carried on and published in botanical

or scientific journals. Botanical gardens, arboreta, and greenhouses are annexed to several, to serve the purposes of the demonstrator or investigator.

St. Louis may be justly proud of its magnificent Shaw Botanical Institute, which, under the direction of a distinguished botanist, is destined to be a model school for scientific botanists, agriculturists, and horticulturists.

In our own State the Agricultural Experiment Station has, since several years, done excellent work, and issued valuable instructive publications for the farmers of the State. This institute ought to be enlarged so that it could also embrace forestry, and should have two auxiliary experimental stations, one in Middle Tennessee and one in West Tennessee, added to the field of its activity.

Bacteriology, formerly a branch of botany, but now enrolled with biology on account of its far-reaching efficiency, has lately found a representative in connection with the Vanderbilt Medical College, and through the munificence of Mr. George Vanderbilt, and under the care of an eminent bacteriologist, who for several years had attended the bacteriological laboratories of France and Germany. It offers ample opportunities to the student who enjoys the use of an equipment which is provided with all modern appliances.

I am confident that the time is not far off when we will have institutions endowed with the fullest outfits in libraries, instruments, greenhouses, and botanical gardens, for original work conducted by the heads of the departments, or by students under their direction. The newly acquired colonies offer the most inviting locations in the tropics for biological stations.

I undertook the wearisome and painful task to delineate in outlines the period from the downfall of the Alexandrian school to the revival of letters in Italy; to remind the reader to what fearful depravity mankind will sink when, for sake of hegemony in religion or politics, for hierarchy or imperialism, the light of reason is put out and intellectual darkness is spread over the land to shield the despoilers from responsibility; no longer by fire and sword, yet by supple and con-

cealed ways is presently waged the assault against freedom of conscience and diffusion of knowledge.

That the important results which followed the recent investigations, that discoveries which so irresistibly fascinate botanical students, that such intellectual commotions excite but little attention in wider circles of society, for that we need not accuse the specific or abstruse character of the problem, but rather hold the deplorable inadvertency of our educational system responsible for it.

Continually treading in the steps of antiquated methods, the schools neglect to stimulate and encourage a love of nature and its works, and withhold the necessary elementary instructions, without the aid of which a lively interest and intelligent comprehension of scientific questions is not possible.

Conditions and wants of society are changing, and methods and maxims which formerly suited the political state have lost their meaning. Modern thought leads to the conviction that the interactions of conditions upon which depends the status of society are governed by physical laws, definite and unalterable, like those which control the development of plants. How governments should direct those movements is not a matter of sentiment and feeling, but a purely scientific question.

In the present educational system memory gets loaded with a heavy charge of book learning, consisting of disconnected doctrines, all of them necessary for the practical wants of our times—the ideal demand of general culture. The want of correlation between this heterogeneity, now divested of intelligent means to bridge over the mental chasm, is a fundamental deficiency of our higher education.

A philosophical method of thinking, the essential of which is the endeavor to comprehend the interrelations of actions and phenomena in the physical and ethical world, through which the individual feels himself inseparably allied in harmonious concert with Infinity, is needed. The reverse tendency, which now pregnantly characterizes society, is a declared particularism, a premature application to specialty vocations, controlling a narrow intellectual horizon. Hence originate the fluctuations of opinions, and the diverse monomanias in religious,

social, and other spheres; hence the thriving of spiritualism, Christian society, single tax folly, silver swindle, and other fads. Would this deportment be restricted to the class of the half educated, then the danger would not be so threatening as it really is, when we see that college graduates, educational leaders, and university professors are likewise destitute of the necessary philosophical training.

May, therefore, instruction in the natural sciences become more general and thorough; may the spread of scientific culture strengthen the scientific spirit and make it a world-conquering power!

Unbiased by authority, loving the truth for its own sake, may it secure the happiness of the Commonwealth!

## FORESTRY.



Tho' floods, with time, some roots have bared,  
Blasts the limbs have bent and gnarred,  
The bark by birds is pecked and scarred,  
Green stayed the crown and unimpaired;  
Sweet songsters' quiet nesting berth,  
It shelters now the timid herd.



## The Forest.

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Of the many obstacles the human race has had to contend with to maintain its existence, increase in number of individuals and ultimately gain mastery, not the least one was the woods, where they in overwhelming expanse spread over continental regions. They offered more adequate shelter, and more copious and better adapted food to the mightier animals than to him, hemmed in his steps, and prevented his gathering into larger groups. This circumstance governed for long periods the fate of our ancestors in the northern latitudes of the Eastern Continent. After the retreat of the Glacial period we find him following the shore lines from the Baltic to the Biscayan Gulf as a shell and fish devouring savage, or cave-inhabiting troglodyte.

In the highlands of Central Asia he first multiplied in such numbers that he commenced to direct his migrations westward into the deep forests, upon paths which, perhaps, the woolly rhinoceros and herds of woolly elephants had broken and tramped out for him. The extension southward found a barrier in the ice-glittering ranges of the Himalayas and Hindu Kooh. At this time, when thousands of years before our era this first westward movement began into the Sarmatian plains, into the regions of the Danube and Wolga, empires had commenced to form in the deltas of the Nile, Euphrates, and Tigris, and all around the great Mediterranean Gulf. With a benign and generous smile nature invited him to groves where the date palm bore weighty clusters of its luscious fruit, offering a delicious meal; fruit-laden carob trees, with spreading limb, gave nutritious food for him and his herds; groves of olives, chestnuts, and walnuts alternated in the scenery in the wide territory from the banks of the Ganges to the shores of Lusitania, where the rosemary mingles with the noble grape and the granate apple; Ceres had thought to strew the nutritious barley on the overflowed waters of the Nile and Euphrates, and the rich harvests were

easily and safely garnered; plenty spreading all around, even the animal world came to the aid of their nobler brother; the proud Apis had bent his nervy neck under the yoke, sheep flocked around him, and camel and elephant lifted him on their backs.

Thus did the Southland empires flourish and decay, while the Northland barbarian made little headway in clearing openings, and prepared with the meanest tools the virgin soil for the production of a little oat and rye and flax, until the Scandinavian had discovered the art of making iron from the rich and easily reducible ores buried in his mountains. Swinging the iron ax, no tree could stand before him; the hammer opened the treasure vaults of the mountains, the plowshare laid out broader fields, and with the sword in his fist he overwhelmed the Roman intruders in the Herzynian forest.

With the spread of civilization the demand for wood grew from year to year, and after the lapse of centuries fields and meadows overreached in expanse the woods, for whose preservation little thought was given. They were no longer common property, but were divided out amongst communities, or held as private property by princes and noblemen. They were principally valued as resorts and retreats of all kinds of game, the chase being the principal sport and amusement of the nobility.

The continued despoliation of the woods wrought at last in the mountainous as well as seashore regions of Central Europe severe injury by denudation of the mountain slopes, and consequent inundations, such that enlightened individuals, and the governments themselves, realized the necessity of protective legislation enactments against unlimited felling of trees.

Restorative efforts on scientific plans, with a view of permanence in supervision have been carried on in France, Germany, and Italy at enormous expense and with great success for more than one hundred years.

History is now repeating its lessons in the vast realm of the Union, where, by the unparalleled development of the country, the demand for timber has grown out of all propor-

tion for a continued supply under the unchecked inroads of the lumber trade, and the unparalleled facilities for internal transportation by navigation. The importance of the forestry interests have induced me to devote some pages to this department of our national economy, and to notice the emotional and æsthetic impressions upon the human mind evoked by the forest in the aspect of nature.

It is interesting to observe the difference in the sentiment and association of thought as it ever existed between the southern and northern inhabitants of the old continent.

The aspect of, or sojourn in, the woods filled the Greek as well as the Roman with fear and dismay; he avoided them as habitations of robbers and wild beasts. From Homer to Tacitus poets and historians paint it in the darkest colors, as the dark abode of demons and monsters, filled with entangling thorns. "Subit aspera silva lappægue tribulique"—"Here is the dismal wood with thistles and tangles uncouth." (Virgil.)

The German mythical folklore spins the finest threads of its poetical mood under the deep shadows of beech and oak.

Over the Rhine into the tanwood, where fir and pine thickly crowd, storms the baneful chase of King Gunther; on the spring underneath the linden sinks the dying Siegfried into a bed of flowers, pierced by the spear of Hagen; Genofeva hides from the ire of her husband in the depth of the forest; Hildebrand and Hugobrand, the greatest swordsmen of their day, cross their swords in furious combat, until Hildebrand recognizes from the weight of his strokes that his combatant must be his son; here gathers Cinderella blueberries, and fragrant woodruff for spicy May wine, and loiters the bard, spinning the yarn for his songs with which he cheers the dauntless hearts of the champions when the mead-filled horn makes the rounds.

The poetically inspired naturalist covets a response from his dear favorites, Flora's children, to his own love of them, and is sore at heart and loath to believe that the graces of their forms, splendor of coloring, and the sweet breath of their exhalations should delight and benefit creatures only far remote in the scale of life from themselves, without any gratification to their own selves; that they should be without any partici-

pation in the endearment with which they fill the human hearts. It appears contrary to the demands of human reasoning that so much individuality should exist without some kind of consciousness or subjective individuality.

Especially in their higher and enduring arborescent forms plants are typical of the attainment of the ideal endeavors of man, to accomplish in the historical evolution of the race that well-balanced social state in which the single citizen, in accordance with his abilities, may contribute to the general welfare, and partake of the emoluments equally accessible to all. Within their bodies the component cells and structures may change, be altered, die, and be regenerated, the whole remaining a personal perpetuity lasting for ages. This is beautifully expressed in the *Xenia* of Goethe, when he says:

Such du das Schoenste, das Hoehste?  
 Die Pflanze kann es dich lehren!  
 Was sie willenlos ist, sei Du es willend,  
 Das ists.

Do you ask what in beauty and goodness  
 Ranks high beyond measure?  
 Be taught by the plant; what she does without choice  
 You do it freely with pleasure.

# The Introduction of a National Forestry Policy in the United States.

It is about twenty years since for the first time in an official way the attention of the Federal Government had been called to the importance of providing means of protection for the forests within the national domain, against excessive and improvident despoliation.

It was ex-Senator Carl Schurz who discussed, as Secretary of the Interior, the necessary evil consequences of the present practice of forest devastation, and the responsibility of the present generation in permitting and perpetuating practices of public policy which would soon lead to irreparable injuries to the future welfare of this great republic.

Mr. Schurz's world-wide experience was in this instance based upon his personal observations of the forestry management in Germany and France, and the disastrous consequences that in the latter country had followed the reckless treatment of the forests in the last century, and which ultimately, by stringent legislation, and at enormous expenditures, had to be brought to an end, and restoration secured by a well-devised forestry administration.

The remarks of Mr. Schurz were, for a time, treated with some merriment; and even Mr. Blaine, as wise a man as he was, would join in the ridicule, and call Mr. Schurz a German idealist—to which, however, the latter did not let Mr. Blaine wait a long while before giving him a sharp rejoinder.

There was then scarcely a man amongst the native citizens who was not fully persuaded that the wealth of our woods was imperishable, and that the benignant hand of nature would fully replenish the deficiency without calling upon the aid of man for minding and nursing.

It was only within a few German circles, scientists, and practical foresters, who had seen in their old homes forestry management, or even functioned as forestry officials, where

the immensity of the threatened danger was fully appreciated, and who knew that the coming generations would sorely suffer for the faults of the fathers.

The census reports had meantime given indisputable facts relative to the great losses within the forest region of the ever-recurring conflagrations and the actual amount of lumber culled in successive years.

A generally better comprehension of the period of time which nature requires, even under the most favorable conditions, to effect a restoration, and the understanding of the obvious disturbances in such a process in territories unguarded by effective protection against any kind of abuse, soon created a reaction in public opinion. An agitation which had been started in behalf of an establishment of forest reservations, with national grants, and through provisions enacted by State legislation, soon grew in public favor, and the creation of a National Forestry Association was the first important result of this movement.

The National Forestry Association is mainly composed of the membership of the different State Forestry Associations, and holds annual migratory meetings. Nearly every State in the Union now has such a forest association.

This work was started and guided along through the unceasing labors and invincible energy of two citizens. The one, Professor B. E. Fernow, the former Chief of the Forestry Division of the Agricultural Department in Washington, is a native of the Prussian Province of Pommern, a graduate of the Forestry Academy of Munden, who, after having served as a volunteer in the Franco-Prussian War, entered the forestry service (as an aspirant to the higher forestry service). He resigned this position to emigrate to this country. Soon afterwards he was married to an American lady, a woman of great talents and high culture, who, with the fullest apprehension of the worthiness of his intentions, was a devoted and skillful aid to the advancement of his well-conceived plans. Undisturbed by the change of the different administrations has he, until recently, presided over the Forestry Division of the Agricultural Department; but recently (in 1899) he accepted the

charge of Director of the Forestry College of Cornell University, Ithaca, N. Y.

The other gentleman is G. Pinchot, a private citizen, a descendant of an old, distinguished New England family. In his travels through Germany he had made the observation of the agricultural and economic condition of the latter country an object of close and extensive study. The still preserved productiveness of its soils, and the marvelous preservation of its forests impressed him so profoundly that he concluded, after his return, to bring to public benefit the conclusions which he had drawn from his observations. Assisted by his friends, he succeeded in the foundation of several forestry associations in the New England States, and holds now the position of Consulting Forester to the National Forestry Association, with offices in New York and Boston. He speaks German very fluently, and most cordially receives any visitor who wishes to call on him to either receive or impart information.

These societies initiated their movements with petitions to Congress, as well as to the State Legislatures, for the enactment of laws for the protection and preservation of the forests in general, and the national domain in particular.

It had also been noticed that the frequent conflagrations had not only reduced the extent of the timbered area, but also fearfully depleted every kind of game. Thus repeats itself in the new continent the ancient experience of the necessary and natural correlation of the existence of the game with the protection of the forests. Numerous associations of sportsmen and hunters joined in with petitions for protective hunting laws and restriction of the chase within limited periods. Individuals convicted of willfully setting fire to the woods were made liable to severe punishments.

This was all very good theoretically, but practically the laws were dead letters only, there being no provisions made for their execution by persons specially appointed and intrusted with the execution of the same. There was but little sympathy as yet among the masses for absence of comprehension of the subject. In various States, foremost in Wisconsin, where the numerous German population had considerable po-

litical influence, likewise in Minnesota and Michigan, forest guards were appointed to look after forest fires; while in Maine, Massachusetts, Pennsylvania, and New York the protection of the game was principally thought of. Both these functions do necessarily coincide to effect that kind of service which in Germany is comprehended under game and forest keeping.

It is interesting to notice how the same events which in all European countries led to the introduction of a regulated forest administration give also here again the impulse for the like provisions. There, like here, wood was cut for the local needs in building and firewood, without any reflection or care for the welfare of posterity, and would perhaps permanently have sufficed with the natural aftergrowth for all the time to come; but with the increase of the industries, mining, and shipbuilding the deficit in heavy timbers made itself felt, and preventative measures against excessive depletion had to be instituted.

Thus it came that toward the end of the Middle Ages, first Venice, the "Queen of the Seas," enacted laws in which she reserved certain forests exclusively for use in her shipyards, and also laid restrictions for the cutting of timbers in private estates, and placed the management of all under a regularly officered administration. Holland, Belgium, France, and England took similar measures.

Relations of a different character ruled in Germany, where the passion for the chase indulged in by princes and nobility drew their attention to the preservation of the forest.

The right of hunting big or small game was a royal prerogative or privilege of the landed nobility. Their numerous retinue of huntsmen constantly on the lookout for poachers, expert in all things in connection with woods and their inhabitants, formed a sort of clannish organization, and formed an excellent contingent for the gradually developing intelligent supervision of forests, and by and by became converted into a professionally and scientifically educated corps of public service with military organization. Care for the protection of game is in Germany inseparably connected with the economic management. In a similar manner must we also begin to start

a crew of foresters until regular schools of forestry will have been established.

After the first steps had been made with the appointment of wardens and gamekeepers in various States, it was necessary, in order to secure rational proceedings, to procure ample statistical data, to give exact information about the extent, situation, and condition of the still unoccupied and timber-clad public domain. This work had been carried on by the forestry division with great success, and the annual reports of its chief kept Congress so well informed and interested that on March 3, 1891, the President was empowered to issue a proclamation that such suitable parts of the public lands as had not yet become private property should be reserved as forest reservations. In addition to the Yellowstone National Park, which is indeed but a great forest and game reservation, there were next such reservations selected as are interesting in historic, scientific, or economic respects. Thus the Yosemite Reservation in California, where are the last remainders of the once extensive stands of the giant sequoia, should be preserved and rescued from total extermination.

It was furthermore considered as a matter of great importance to preserve extensive bodies of wooded territories at the head waters of the great streams, to maintain the water supply, and regulate it to prevent excessive inundation.

In this way had taken place the foundation of a great many reservations in the West and Northwest, when, in the beginning of the year 1897, President Cleveland issued another proclamation which secured at once seventeen more reservations, with a total area of more than 21,000,000 acres. This famous act of prudent statesmanship was prompted through a report of the National Academy of Science, made on request of the Secretary of the Interior, Hoke Smith. This committee was composed of the most distinguished scientists and experts of this country, and they had for their investigations a fund of \$100,000 at their disposition. Divided into several divisions, they explored carefully the limits, nature, and conditions of such regions as they thought best suitable for permanent reservations. The commission in the final report also earnestly recommended to introduce and establish a regular forestry

administration, after the methods of the European, especially the German, forestry.

Here it was for the first time that recognition was given to the necessity of regular forestry administration, having in view not only the preservation, but also the exploitation, management, and rejuvenating of the forests, after the example of the German forestry system, through educated professional forest officers.

One would think that the readiness with which the energetic President Cleveland responded to the proposition of the commission would have been received with the greatest satisfaction and immediate acceptance in the halls of Congress. On the contrary, it raised a storm of indignation amongst Representatives as well as in the Senate. Especially the latter suffered itself to be influenced by those great combines which drew enormous revenues from the despoliation of the woods, selling the lands afterwards again to actual settlers. Government supervision would have put an end to their speculations. A bill passed the House setting aside the proclamation. It was returned with the President's veto. The matter was laid over until March 1, 1898, and a resolution passed that the new reservations should be again surveyed, and remain as such, provided that not before the expiration of said time they should have been otherwise disposed of. It is evident that no change will occur from Mr. Cleveland's policy.

An actual beginning of a national forest administration has furthermore taken place through the issue of regulations of the General Land Commissioner in Washington, who is intrusted with the supervision of the forest reservations concerning the sale at public auction of all timbers allowed to be cut on the public lands. The felling and transporting of the logs is also governed by specific regulations.

The first methodic and scientific forest administration is, since a few years, engaged in active work upon the extensive possessions of Mr. George Vanderbilt in Biltmore, N. C. The forest administration is under the direction of Dr. C. A. Schenck, a graduate of the University of Giessen, Germany. A forestry school has been opened in the same place.

Mr. Vanderbilt has furthermore made a proposition to the

trustees of the University of the South, at Sewanee, to place there, at his expense, a forester and a forest school for the regular management of the extensive area (10,000 acres), owned by the University of the South on the Cumberland plateau around Sewanee.

The course of instruction prescribed in German forest schools, or academies, embraces the following lectures: (1) A: Fundamental Instruction: General and agricultural chemistry; (2) mineralogy and geognosy, with special instructions in soil analysis; (3) botany as general botany, or plant physiology and forest botany; (4) general zoölogy and forest zoölogy; (5) physic, meteorology and climatology; (6) general mathematics, with surveying and drawing; (7) theory of mechanics; (8) national economy; B: Specialties: (1) Forest planting and maintaining; (2) forest protection; (3) utilization; (4) forest mathematics; (5) designing and locating plots; (6) bookkeeping and forest police; (7) gamekeeping; (8) history of science of forestry.

In answer to the question raised about the financial results of a regular forest administration as a branch of State or national government, I copy from the Forester of March, 1898, the following abstract on the forest management of the kingdom of Bavaria:

#### **Financial Results of Forest Administration in Bavaria.**

In this small kingdom, with over 5,000,000 people on an area of about 29,000 geographical square miles, or about half as great as that of the State of Wisconsin, and with about 40 per cent mountain district, the forest has long been recognized as an indispensable part of a well-to-do Commonwealth. Even during the Middle Ages the cities and religious bodies, such as monasteries and churches of this region, accumulated forest properties. The "Nueremberger Reichswald" had become famous in the sixteenth century, and as early as the year 1616 definite forestry regulations helped to develop a judicious use of the woods and their maintenance on all exposed mountain lands.

For over forty years the forests of Bavaria have covered in the neighborhood of 6,000,000 acres, or about 34 per cent of the

total area, and they have been owned all this time in about the same proportions—namely, about one-third by the State, one-half by private owners, the rest by villages and corporations.

The policy of the State has been during all this time to increase its holdings wherever practicable, and more than \$8,000,000 have been spent in the way of land purchases since 1830. But even with private owners a similar disposition exists, and though the right to clear land is given wherever this may be shown to be fit for agricultural purposes, there has been almost as much land restocked with woods by private owners and villages as has been cleared, so that the total holdings of private owners have not been reduced through clearing by more than one-third pro mille. Of the 6.2 millions\* acres of forest, about 46 per cent is stocked with spruce and fir, usually harvested at an age of about one hundred and twenty years; 30 per cent is pine (nearly all Scotch pine—a hard pine resembling our red or Norway pine), largely used as a firewood, and generally cut at an age of eighty years and less. The rest is stocked with hardwoods, mostly beech, which is allowed to grow to an age of about one hundred and twenty years; some white oak (*Quercus pedunculata*), part of which is managed as tanbark coppice, being cut down every fifteen or twenty-five years, and part is allowed to grow into larger timber, for which about one hundred and eighty years are necessary in this region. The yield of cut per acre is generally large. Groves one hundred years old, cutting 10,000 cubic feet of timber per acre, are by no means rare in the forests of the foothills, and even the poor rocky Alpine ranges are made to yield during the same length of time from 3,000 to 4,000 cubic feet. In the State forests about 61 cubic feet per acre grows, on an average, every year over the entire area, so that they furnish an annual cut of about 126,000,000 cubic feet of timber and firewood.

In the private forests the growth and consequent yield is generally smaller, since less care is had and less skill displayed. Nevertheless, according to a thorough examination made about 1860, the growth even in this private and village woods amounted to about 54 cubic feet per acre and year.

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\* State and private ownership.

With increased care the State forests, of which not over 5 per cent is unproductive as rocky wastes, roads, etc., have been made to yield more wood and a greater money return. Thus:

In 1829 the cut was 35 cubic feet of wood (from all growth measuring over five inches in diameter); in 1850 the cut was 44 cubic feet; in 1860 the cut was 48 cubic feet; and in 1866 the cut per acre had increased to 60 cubic feet.

While in 1850 fully 84 per cent of the cut was still firewood, this inferior class formed only 67 per cent in 1880, and this proportion is still changing in favor of bole-size material, as the average age and size of the timber increases, being nearly half and half in 1896.

The money returns of Bavarian State forests have not been so great as those of the forests of Saxony and Württemberg. This is partly due to a prevalence of mountain lands, which reduce the yield, increase the cost of all operations, and partly also to a less intensive management. Nevertheless, improvements in methods have led to fully as great an advance in the net revenue here as in the neighboring States, so that the net income, which was only \$1 per acre and year in 1850, is now \$1.92, or nearly double that amount.

In this way the little State of Bavaria has a net income from its forest property alone—2,091,930 acres—of nearly four million dollars per year, after paying out in wages for supervision, logging, planting, etc., a like amount, the net revenue presenting in 1896 just 50 per cent of the gross income.

Considering the many difficulties of stocking rough Alpine and other mountain lands with forests, it is noteworthy that of the total expenses only 8 per cent, or about 10 cents per acre and year, is devoted to that silvicultural part of the work—i. e., to planting, sowing, gathering seed, nursery work, etc.; while 50 per cent is paid out for supervision, and 50 per cent for cutting and logging.

It is also of interest in this connection to note that it was not by a shortsighted, stingy policy of retrenchment in expenses, but by a liberal policy that the forests have been made to furnish a steady and cheap supply of timber to hundreds of mills, cheap firewood to the whole people, and a net income which, if regarded as an interest on the value of the forest

property, makes this, at the prevailing 3 per cent rate, worth \$130,000,000, or \$65 per acre, for land which without the forest cover would hardly bring \$10, even in these densely settled countries.

Instead of expending only 80 cents per acre and year, as was done as late as the year 1860, Bavaria now expends more than double this amount, pays higher salaries, and maintains a larger force of steady workers; it spends about a quarter of a million per year on roads and other permanent improvements, and at the same time improves its woods, has more standing timber of larger average size, has more wood growing, and receives more money from this resource than ever before.

Preservation of forests must come about largely by the absolute ownership of lands, either by the nation, State, or associated capital. The management must be controlled by national or State supervisors, amenable to definite forest laws. Preservation of the forest does not mean to keep the ax out of the woods, but to use it rationally. In all natural woodlands must a constant culling be practiced, in order to insure the greatest possible thriftiness in timber growth. This selective thinning out by felling the mature or diseased individuals or undesirable species is for the present the only one practicable form of management.

If in any region certain kinds are particularly wanted in aid of certain industries, such would, without delay, be planted or sown, especially when younger growth is preferred, like in the pulp industry. The paper mulberry makes a very rapid growth, thrives in any soil, and is well suited for the South.

Large areas in the State of Tennessee are unfit for profitable agriculture from poverty of the soil. The spare population wears out a toilsome life without hope for improvement. Schools of the lowest grade and inadequate to effect intellectual improvement give no encouragement in some kind of home industry, and they are ultimately forced to seek employment in the mines. The legitimate remedy would be to put such districts under forest culture. The timber question is a vital point in the life of the coal-mining industry in the Cumberland Mountains, and not less so to the iron, copper, and other industries in East Tennessee, and a promising field is

open here to capital in buying up such tracts for forest culture. Many tracts of land in East and Middle Tennessee are so excessively rugged that only here and there may small patches admit of plowing. The surface, although in the main level, is full of rocks of all sizes, like a mighty convulsion had stirred up the surface of the earth. The cause of this phenomenon is the geological structure, consisting of alternating thin strata of fossil limestone and shale, which, unequally corroded, and the latter partly washed out, causes displacements under all degrees of angles, and this rough-and-tumble aspect. The surface is so deeply rifted that the far-reaching cedar roots find moisture in the depth when the surface is parched. This region is naturally reserved for the cedar, especially so as it is also unfavorable for the growth of other conifers on account of the great dryness of the air in the summer season in the middle division of the State. Cedar and hackberry would be the forest composition. Very recently an enterprise has been planned which, if successfully carried into execution, would immensely benefit our State. An association composed of citizens of several States, known under the name of the National Park Association, has addressed a petition to Congress explaining the desirability of establishing a national park in the Southern Appalachian region. Petitioners state that upon unquestionable authority of our foremost botanists, like Prof. A. Gray, Professor Sargent, and others, no more suitable reservation could be selected anywhere within the boundaries of the United States than the one to be described hereafter. There is a greater diversity of hardwoods and conifers within limited areas in the Southern Appalachian Mountain chain in the grandest development of growth than could be gathered over the whole of Europe, or in the latitude of Philadelphia, from the Atlantic Coast to the mountains of Colorado.

This area is also blessed with the embellishment of the most gorgeous and peculiar species of herbaceous plants, and an exploration of those high summits will always leave in the mind of the lover of nature's scenic grandeur emotions of enchantment and fascination.

The forests of this region are all of a "mixed stand," to give

the English version of the German term "bestand." They are in no part made up of but one single kind, but of conifers and hardwoods intermingled in very diverse proportions.

Now, before the extension into this region of extensive railroad lines and intersections, and the intrusion of numerous forest-destroying mining operations, would yet be an opportunity to secure large and coherent tracts of mountain lands in the virgin state of nature.

The forest, once destroyed, will within the borders of culture not spontaneously restore itself, as we have learned from experience on the old continent. We also know that artificial reforestation is a slow process, calling for lifetime energy and expenditure of succeeding generations. Government aid and direction has to be depended on in such operations, which do not yield an immediate compensation. Moreover, the government alone can clothe its officials with such authority as will be necessary to protect such territories against destructive inroads. The areas as presently planned, cover the heads of all the water courses flowing west into the valley of East Tennessee. These in their descent, cutting narrow gulches through the rugged mountain masses in grades of several hundred feet from their heads to the flood level of the valley rivers, represent an available amount of energy representing millions of horse power. The continuance of this energy depends entirely on the preservation of the forests at their sources. They are the guardians of the industrial life of East Tennessee. Yet another quality peculiar to this region is its unexcelled suitability for health resorts. The abundant springs draw their cool and limpid waters from silicated or granitic rocks; are free from calcareous, magnesian, or aluminous impurities. Ferruginous springs, on the contrary, are not infrequent. Other blessings are the absence of the mosquito plague and freedom from malaria.

As the forests are nearly half and half composed of conifers, the air is charged with balsamic fragrance and richly ozonized. The obnoxious Northwestern gales do not reach over that far East, although they are yet felt on the Cumberland plateau. On the contrary, warm and moist breezes are frequently wafted up from the Caribbean.

The mildness of the climate makes this region accessible at all seasons of the year, and even the highest summits remain but a month or six weeks snow covered. The Western national parks are, from the rigor of their prolonged winter period, accessible for only about five months.

Duly central to the Northern seacoast, Toledo, Chicago, St. Louis, and New Orleans, could this region be readily reached by millions of people within one day's travel.

The tracts, as now proposed for a reservation, lie between 32 to 35 degrees north latitude, and 82 to 85 western longitude. The central or highest crests of the Balsam and Smoky Mountains traverse it from southwest to northeast, with the greatest expanse of surface to the east. The present survey takes in a strip of McMinn, Blount, Sevier, Cocke, and Greene Counties, in Tennessee; nearly the whole of Graham, part of Swain (and the Cherokee reservation), part of Haywood and Madison, and nearly the whole of Yancey, in North Carolina; or probably 2,000,000 acres of mountain lands.

The State of Tennessee ought to make a strenuous effort that all the headwaters of the Hiwassee and Ocoee Rivers, to their ultimate sources in North Carolina and Georgia, should also be included in this reservation. The greatest opportunities for mining enterprises are open in this region for building stones, granites, and slate quarrying, besides gold, copper, iron, asbestos, and gems, not to speak of the natural and lasting products of a national forest management.

The success of this enterprise lies within the power of, and depends upon, the appreciation of its merits by the present Congress. Since the writing of these lines the present Fifty-second General Assembly of the State passed a joint resolution by both houses memorializing Congress through our Representatives, and petitioning for a national grant. The General Assembly declared its readiness to cede all State rights against compensation to present owners to the Government of the United States, recognizing its absolute domain.

The State of Georgia has also sent a similar petition and instruction to its Representatives in Congress, effecting thereby a joint action of the three States of North Carolina, Tennessee, and Georgia.

I have adjoined below the message of the President to Congress, January 16, 1901, in relation to the Appalachian Mountain Reservation, Secretary Wilson's report on the contemplated National Park, and Senator Pritchard's bill for the appropriation of \$5,000,000 for the execution of the Appalachian Park Bill:

To the Senate and House of Representatives:

I transmit herewith, for the members of the Congress, a letter from the Secretary of Agriculture, in which he presents a preliminary report of investigations upon the forests of the Southern Appalachian Mountain region. Upon the basis of facts established by this investigation the Secretary of Agriculture recommends the purchase of land for a national forest reserve in Western North Carolina, Eastern Tennessee, and adjacent States. I recommend to the favorable consideration of Congress the reasons upon which this recommendation rests.

WILLIAM M'KINLEY.

Washington, D. C., January 3, 1901.

The President:

The bill making appropriations for the Department of Agriculture for the fiscal year ending on June 30, 1901, provides that a "sum not to exceed five thousand dollars may, in the discretion of the Secretary of Agriculture, be used to investigate the forest conditions in the Southern Appalachian Mountain region of Western North Carolina and adjacent States." In accordance with this provision, I have made a thorough investigation of the forests in a portion of the Southern Appalachian Mountains, as directed above, including an estimate of the amount and condition of the standing timber, an inquiry as to the suitability of this region for a national park as proposed by the Appalachian National Park Association, and an examination of the validity of the reasons advanced by its advocates for the creation of such a park. In this task I have received generous and effective coöperation and assistance, through the United States Geological Survey, from the Department of the Interior, which recognized in this way the deep and widely-diffused public interest in the plan.

The forest investigation was made to include a study of the character and distribution of the species of timber trees, the density and value of forest growth, the extent to which the timber has been cut or damaged by fire, the size and nature of the present holdings, the prices at which these forest lands can now be purchased, and the general and special conditions that affect the prosecution or conservative forestry on a large scale.

The hydrographic survey of the region conducted by the United States Geological Survey includes a general study of its topographic features; of the relation of the soils, forest cover, and rainfall; of the

quantity of water flowing out of it through the various streams during different seasons; and of the influence exerted on the regularity of this flow by forest clearings. More than 750 stream measurements have already been made, and much additional data of special value has been secured.

In addition to these investigations, I have given thorough attention to the arguments advanced by the movers for the proposed park and to those of their opponents, and as a result I am strongly of opinion that this matter is worthy of careful consideration.

I have the honor to transmit herewith a mounted original copy of a large map, which shows in detail the mapping of forests accomplished during the past summer over an area of nearly 8,000 square miles. A full report of the work and of its results is now in preparation and will be submitted for your consideration at an early date. The following preliminary statement is made to bring before you without delay a summary of the facts sufficient to set forth clearly the principal features of the region and the plan:

The movement for the purchase and control of a large area of forest land in the East by the government has chiefly contemplated a national park. The idea of a national park is conservation, not use; that of a forest reserve, conservation by use. I have, therefore, to recommend a forest reserve instead of a park. It is fully shown by the investigation that such a reserve would be self-supporting from the sale of timber under wisely-directed conservative forestry.

Extensive areas of hardwood forests within the region colored on the accompanying map are still in their primitive condition, and these are among the very best and richest hardwood forests of the United States. The region in general is better adapted for forestry than for agricultural purposes. It is located about the head waters of numerous streams—such as the Ohio, Tennessee, Savannah, Yadkin, and Roanoke—which are important both for water power and for navigation. The general conditions within the region are exceptionally favorable for the carrying on of large operations in practical forestry, and the weather is suitable for lumbering operations at all seasons of the year. It contains a greater variety of hardwood trees than any other region of the United States, since the Northern and the Southern species here meet. It is a region of exceptional beauty and picturesqueness; and although it would not be easily accessible to visitors in all parts at all seasons of the year, by far the greater portion of its area would be easily reached and climatically pleasant throughout the year. It contains within the forest-covered areas no large settlements or large mining operations which would interfere with the management of such a forest reserve, and yet there is a sufficient population for the working and protection of the forests. Large lumber companies are rapidly invading the region, and the early destruction of the more valuable timber is imminent. Lands in this region suitable for such a forest

reserve are now generally held in large bodies of from 50,000 to 100,000 acres, and they can be purchased at prices ranging from \$2 to \$5 per acre. It is probable that the average price would not exceed \$3 per acre. In explanation of the widespread and urgent demand for the establishment in this Southern Appalachian region of a national park, or forest reserves, it may be added that it contains the highest and largest mountain masses and perhaps the wildest and most picturesque scenery east of the Mississippi River; that it is a region of perfect healthfulness, already largely used as a health resort both summer and winter; and that it lies within little more than a day's travel of the larger portion of the population of this country.

The rapid consumption of our timber supplies, the extensive destruction of our forests by fire, and the resulting increase in the irregularity of the flow of water in important streams have served to develop among the people of this country an interest in forest problems which is one of the marked features of the close of the century. In response to this growing interest the government has set aside in the Western forest reserves an area of more than 70,000 square miles. There is not a single government forest reserve in the East.

I have the honor to be,

Very respectfully,

JAMES WILSON, Secretary.

#### APPALACHIAN PARK BILL FOR THE APPROPRIATION OF FIVE MILLION DOLLARS.

Section 1. Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of Agriculture is hereby empowered and directed to purchase land, suited to the purposes of a national forest reserve, in the Appalachian Mountains, within the States of Virginia, North Carolina, South Carolina, Georgia, Alabama, and Tennessee, in total extent not to exceed two million acres, and to care for, protect, use, and make accessible the said forest reserve or any part of it when so purchased.

Sec. 2. That the Secretary of Agriculture is hereby empowered and directed to make such rules and regulations and establish such service as he may deem necessary for the care, protection, and use of such forest reserve, and to sell such wood and timber as may be removed without injury to the forest; provided, that no wood or timber shall be sold otherwise than by public auction, except to actual settlers, and in no case at less than the appraised value thereof; and provided, further, that the proceeds of such sale shall be covered into the treasury of the United States.

Sec. 3. That the sum of five million dollars, or as much thereof as may be required, is hereby appropriated for the purchase of lands for a national forest reserve, as hereinbefore specified, said reserve to be known as the Southern Appalachian Forest Reserve; and said five mil-

lion dollars shall be available until the expiration of the fiscal year 1910-1911, unless sooner expended.

Corresponding to the above followed the joint enactment of the General Assembly of the State of Tennessee:

AN ACT to give consent by the State of Tennessee to the acquisition by the United States of such lands as may be needed for the establishment of a national forest reserve in said State.

Whereas it is proposed that the Federal Government establish in the high mountain region of Eastern Tennessee and adjacent States a national forest reserve, which will perpetuate these forests and forever preserve the head waters of many important streams, and which will thus prove of great and permanent benefit to the people of this State; and

Whereas a bill has been introduced in the Federal Congress providing for the purchase of such lands for such purposes; therefore,

Section 1. Be it enacted by the General Assembly of the State of Tennessee, That the consent of the State of Tennessee be, and is hereby, given to the acquisition by the United States, by purchase, gift, or condemnation, according to law, of such lands in this State as in the opinion of the Federal Government may be needed for the establishment of such a national forest reserve in that region; provided, that the State shall retain a concurrent jurisdiction with the United States in and over such lands so far that civil processes in all cases and such criminal processes as may issue under the authority of the State against any person charged with the commission of any crime without or within said jurisdiction may be executed thereon in like manner as if this Act had not been passed; provided, further, that this Act shall apply only to lands in Tennessee lying within twenty miles of the North Carolina State line; that all condemnation proceedings herein provided shall be limited to lands now forest covered; and that in all such condemnation proceedings the right of the Federal Government shall be limited to the specific objects set forth in this Act and in the laws of the United States in regard to forest reserves.

Sec. 2. Be it further enacted, That power is hereby conferred upon Congress to pass such laws as it may deem necessary to the acquisition as hereinbefore provided for incorporation in said national forest reserve such forest-covered lands lying in the State as in the opinion of the Federal Government may be needed for this purpose.

Sec. 3. Be it further enacted, That power is hereby conferred upon Congress to pass such laws and to make or provide for the making of such rules and regulations of both civil and criminal nature and provide punishment for violation thereof as in its judgment may be necessary for the management, control, and protection of such lands as may be

from time to time acquired by the United States under the provisions of this Act.

Sec. 4. Be it further enacted, That this Act take effect from and after its passage, the public welfare requiring it.

Passed April 16, 1901.

E. B. WILSON,  
Speaker of the House of Representatives.

NEWTON H. WHITE,  
Speaker of the Senate.

Approved April 22, 1901.

BENTON M'MILLIN,  
Governor.

These are the initiatory steps by which this priceless gift of nature, the hitherto undefiled retreat of the virgin forest, sacred to bird and beast, still the same as it was before the encroachment of the white man, will be preserved for the coming generations.

Subject to the greed, ignorance, or carelessness of individual owners, the stately groves would soon be rendered unsightly and worthless as dens and covers for bird and beast, which could not escape their utter extinction.

Torrid knobs and blackened stumps would remain only, a witness of human impiety. Under present auspices we will soon see a noble corps of custodians, trained for scientific management in the forestry department of our universities, employing and directing squads of laborers in the utilization, preservation, and embellishment of the reservation.

# Modern Thoughts on the Origin, Evolution, and Significance of Life.

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Ihr Alle fühlt geheimes Wirken  
Der ewig waltenden Natur,  
Und aus den untersten Bezirken  
Schmiegt sich herauf lebend'ge Spur.

—Faust II., Theil.

All the secret working feel  
Of Nature's ever-guiding will,  
And from the abyss deep and dark  
Floats gleaming up a living spark.

## RECENT VIEWS ON PROTOPLASM AND ORIGIN OF LIFE.

By the dissection of living plants and the exposure of their interior structure under the microscope by a moderate enlargement a chambered, or so-called cellular, structure is visible. These chambers appear to be filled with a transparent, aqueous fluid, ascending from the root, and carrying along with it unassimilated nutritive elements. It is called cell sap. Grains of chlorophyll are frequently floating in it. This element of the plant body had been observed and described before 1840.

A close observation, however, of any living cell will reveal another substance, mostly in the form of a slimy, viscid, or subsolid mass, either filling the whole cavity, or only clothing the inner wall with a thin layer, or traversing in thin strings the cavity of the cell. The distinct character of this substance was first announced by Hugo Mohl in 1846, and called by him protoplasm.

This is, in its general bearing, a very well-known, but in its innermost nature a yet totally unexplained, substance. We know about it to a certainty, that it is the basis of life, not alone of plants, but likewise of animals. The protoplasma of each cell also contains a formative differentiation, the nucleus.

From a chemical standpoint it is composed of not less than

four, but generally five, elements—carbon, hydrogen, nitrogen, oxygen, and sulphur—forming the albuminoids, the most complex, variable, and unstable chemical compounds. Here we see how, within the cell, from the circulating nutritive fluid the plastic mass, protoplasm, gradually develops.

The progress of growth proceeds in animals nearly uniformly, in plants from the terminal vegetative points—buds—and in the cambium or peripheral region (green bark). Thence begins the differentiation of tissues, and of the whole series of vegetable and animal bodies, and that mutual interaction by which from the root or stomach nutritive elements are conveyed and elaborated. The production of protoplasm terminates in the maturing and storage of such albuminoids as make up the body of seeds, and fill the cells of tubers, bulbs, roots, and cambium, and provide for the renewal of individual life and nutrition in its infant state. None of the secondary elements or products possess an inherent vitality. The proteins, which are the most complex in composition, are exceedingly prone to decomposition. The simpler hydrocarbons, like lignin, cellulose, starch, the resins, only, are enduring. The most obvious of the protoplasmic forms is the chlorophyll, whose principal function is the separation of the carbon in the process of plant respiration.

Respecting the comparative quantities in the composition of the individual bodies—of proteinic, nitrogenated constituents, and the nonnitrogenated simpler ones—we observe reverse relation. While in plants the amount of albuminoids is comparatively insignificant, we find the bodies of animals nearly exclusively proteinic. Plants increase constantly, during the vegetative period, their supply in albumen, until they enter the resting period. Animals have, without interruption, to renew it, lest they perish.

It is meet to remember that all protoplasmic bodies are subject to a constant process of elimination and renewal, and that the suspension of either effects their immediate death, which under all circumstances is their ultimate fate.

Very different is the problem of the origin of the primitive protoplasm when it takes its rise without the medium of pre-existing protoplasmic bodies. This process is called the "gen-

eratio equivocata or spontanea" by the older authors; by the moderns, "archegonia."

The term "archegony" comprises, in a strictly scientific sense, two essentially different processes, "autogony" and "plasmogony." Under the term "autogony" we conceive the origin of the most simple plasma body in an inorganic fluid—i. e., in such a fluid in which those elements which are needed for the composition of the organic body are contained in simple and constant solutions; for instance, carbonic acid, hydrate of ammonia, binary salts. Contrariwise, the process would be called "plasmogony," if the organic individual takes its rise in an organic vegetative fluid—i. e., in a fluid which contains these essential elements in form of complicated and unstable carbon compounds, in solution (albumen, carbonhydrates, etc.).

The processes of autogony as well as of plasmogony have, as yet, not been demonstrated. Attempts at the solution of the problem of archegony in earlier as well as recent times nearly all refer not to autogony, but to plasmogony, which latter process is of little avail in reference to primordial organic origination. The temporary failure to verify by experiment the possibility of autogony cannot have more than a negative bearing, and does not absolutely prove that under no circumstances such an event ever could have occurred.

The ripened judgment of contemporaneous investigators tends to make it clear that the impossibility as well as the possibility, can never be brought to a tangible demonstration in its ultimate inchoative state. More about this hereafter.

Hypotheses about a natural spontaneous generation were advanced already in the seventh century before our era by the leaders of the Ionian school, the three Milesians Thales, Anaximenes, and Anaximander. The latter especially asserted important fundamental tenets of our modern monism. They pointed out that a natural uniform law is the source of the manifold manifestations, recognized the unity of the whole nature, and the constant transmutations of forms. Anaximander allows that the living creatures have originated in the water, under the influence of solar heat, and that man has developed out of fishlike creatures. Later on we read in the

natural philosophy of Heraclitus and Empedocles, and in the scientific writings of Democritus and Aristotle, allusions to ideas, in which we recognize fundamental principles of our modern theory of evolution.

Two great and weighty fundamental ideas of the theory of evolution are also presented in Genesis, conceived by Moses, in surprising clearness and simplicity—the conception of separation and differentiation, and the conception of progressive evolution or improvement.

All these views hitherto proposed in favor of a specific, mutually unconnected production by creation, lead, upon logical inferences, to that manner of reasoning which is understood as anthropomorphism. Under this term the Creator is conceived as an organism, conjecturing after the manner of man, meditating and altering his plans, ultimately carrying out his designs like a human architect would rear his structure. The miraculous aspect has always been unsatisfactory to those of speculative mind, and was too closely affiliated to other ancient mythological narratives as not to invite modified interpretations. The inconceivable was prominently proposed, which is merely a sophistic evasion, and means to affirm that one entertains no opinion at all and declines to have one.

In contrast with this complete scientific inadequacy of the creative hypotheses, we are compelled to seek refuge in the opposite theory of evolution, if we intend to form a conception serving the purpose of rationally acceptable exposition. We are forced and morally bound to make such an attempt, even if these evolutionary doctrines should cast merely a glimmer of probability upon a mechanical and natural origination of the different species of plants and animals, but the more so if they are able equally as plainly and simply, as also completely and comprehensively to explain all related facts.

These evolutionary theories are by no means what is often, yet falsely, pleaded against them, arbitrary notions or products of the imagination, applicable only to one or the other single organism; they are indeed strictly scientifically supported theories, resting upon a firm and lucid basis, whence the totality of natural phenomena and especially the origin of the organ-

isms may be explained in the plainest manner, as the necessary consequences of mechanical natural processes.

This theory is known as the monistic or mechanical, or also causal, because it applies only mechanical causes, operating with necessity (*causæ efficientes*) in the interpretation of natural phenomena.

On the other hand, the supernatural hypotheses of creation coincide with that totally opposite view of the universe, which, in contradistinction to the former, is called the dualistic, often also teleologic or vital, because of its alleged government of conditions after a design planned upon usefulness and efficiency (*causæ finales*).

The manner in which science attempts to vindicate the monistic theory leads to the following considerations :

Chemistry shows us that all known bodies may, by analysis, be resolved into a limited number of elements or primary substances ; such not furthermore resolvable bodies are, e. g., carbon, oxygen, nitrogen, sulphur, or the divers metals, like potassium, natrium, iron, gold, etc. At present we know of about seventy-five such elements. The majority of them are rather unimportant, and of unfrequent occurrence ; only the lesser number is generally distributed, and forms not only most inorganic objects, but also all organic bodies.

If we compare those elements which compose the bodies of organisms with those elements which are found in the inorganic substances, we are impressed with the fact that there appears no element in the bodies of animals and plants, which could not also be found outside of them in lifeless nature. There is absolutely no organic element.

Be it here incidentally remarked that all these so-called elements are (most probably) only different combination forms of homologous atoms of one absolutely simple primitive substance, "the Mass." The differences between elements recognized at the present day, originate probably in the circumstance that these mass-atoms are arranged in different numbers and positions ; and their atom-groups or molecules stand in different relations to the universal ether which fills space. The group-wise arranged mutual affinity of the elements speaks for this hypothesis, which, however, has not yet been

experimentally demonstrated. It is furthermore supposed that these chemical elements formed prior to the formation of planetary systems, in the evolution of star systems, under conditions of heat, higher than now artificially producible.

The chemical and physical differences existing between organic and inorganic bodies have therefore their material origin not in the distinct nature of the component elements, but in the different way and manner in which they are aggregated into chemical combinations.

This distinct way of composition conditions, consecutively certain physical peculiarities, especially in reference to their density, which at once appear to open a wide chasm between these two groups of bodies. The formed inorganic or lifeless natural objects, the crystals and the amorphous rocks are of a degree of density which we call solid in contradistinction to the fluid state of the water or the gaseous state of the atmosphere.

It will be remembered that these different states of aggregation of the inorganic bodies are not at all due to their elementary nature, but are depending upon certain degrees of their temperature. Every one of the inorganic solid elements may be converted by raising its temperature into the fluid or molten, and by further increase to the gaseous or elastic fluid state. Likewise every gaseous body—e. g., carbonic acid—by sufficient reduction of temperature or increased pressure can be condensed to the fluid, and furthermore to the solid, state.

In distinction from these three conditions of density of the inorganic substances, we find the living bodies of all organisms, of plants as well as animals, in a quite peculiar fourth state of aggregation. This one is neither solid like a stone, nor liquid like water, but keeping the middle between these two conditions, of what may be called a firmly liquid or tumid consistency. In all living bodies, with no exception, is a certain quantity of water bound up in a peculiar way with solid substance, and just by this characteristic combination of water with solid substance comes about the soft, neither hard nor fluid, consistency which, for the coming into existence and the mechanical interpretation of the phenomena of life, is of greatest importance.

The cause of this is principally attributable to the chemical and physical properties of one single element, the carbon.

Carbon is, from our point of view, of all elements by far the most efficient and interesting, because the function of this element plays the most important rôle in the life history of all plants and animals of which we have any knowledge. It is the element which, by virtue of its peculiar inclination to the formation of complicated combinations with the other elements, effects the greatest possible diversity of chemical compositions, and thereby also of the forms and qualities of the bodies of animals and plants. In combining with the other elements it forms an infinite series of formulas through diverse proportions in number and weight.

Foremost in the combination of carbon with these other elements oxygen, hydrogen, and nitrogen (with which also sulphur and phosphorus are frequently associated) arise those extremely important compositions in which we recognize the first and indispensable basis of vital phenomena, the albuminates (proteids).

Proteinic substances have as yet not been found otherwise than in single or aggregate bodies of definite forms, which, subject to the laws of organic evolution, differ, in an ascending series, in complexity of molecular structure, mass and shape of external form, and degree of development of organs for vegetative and physical functions.

Within the recollection of our older botanists or biologists it was firmly believed that the cell was the ultimate autogenic element of bodies, and that the cells took their origin directly from inorganic matter, under the influence of light and heat. Virchow and Schleiden were the first to make clear the erroneousness of this presumption, showing that no cell originates spontaneously, but directly out of another cell. "*Omnis cellula ex cellula*" became the biological maxim.

With the rapid advance in biologic studies and the greatly improved methods in microscopy it was recognized that the cell is a too complicated, too highly organized, and too mutable formation for us, to accredit it with the power to bridge over at once the chasm between the organic and the inorganic.

To remedy the discrepancy, the attention was drawn to the

function of the nucleus, the formative element of the cell, and the formula was changed to "Every nucleus from another nucleus."

The above-given term, "autogony," proposed by Haeckel, could merely serve to circumscribe the genetic act within the nearest possible compass, until his discovery of the "moners," the simplest living organisms, strengthened our hopes to trace up the thread of life to the present.

The first complete observations upon the nature of a moner (*Protogenes primordialis*) had been made by him at Nizza in 1864. Other remarkable moners have been found by him later on the Canaries and Lanzarote, and in 1867 in the Straits of Gibraltar. (The complete life history of one of these Canarian moners, the orange-colored *Protomyxa aurantiaca*, with illustration, is given in the "Natürliche Schöpfungsgeschichte," of Ernst Haeckel, ninth edition, Vol. I., page 168.) Also in the German Ocean, on the Norwegian coast, near Bergen, he found some peculiar moners. An interesting sweetwater species Cienkowski found, and described it under the name "Vampyrella." Another one Sorakin found and named it "Gloidium." Very recently the number of these organisms has been greatly augmented through the efforts of other investigators.

All of them are exceedingly small corpuscles, who, indeed, do not merit the name of organisms, a term based upon the assumption that all living beings are made up of organs, which, like the component parts of a machine, harmoniously coöperate to effect the activity of the whole. These moners, however, are absolutely without structure or nucleus, consisting of a homogeneous plasma. The entire body during their lifetime is nothing more than a mobile particle of jelly, without a permanent form, a minute living speck of an albuminous carbon compound. We assume this homogeneous mass to possess a very complicated molecular structure, which is, of course, neither anatomically nor microscopically demonstrable. The largest moners are of the size of a small pin head; the smallest are the bacteria, which in all probability belong to this order of beings. More simple and imperfect beings could not be conceived.

We have here arrived at the limits of our physical investigation. The nature of light, the properties of the refracting media, and the structure of the human eye will hardly permit us to penetrate deeper into this special investigation.

Of the bacteria we know little more than their external form, their reaction upon certain coloring substances which render their hyaline bodies visible under the high magnifying powers which we have to use to make them visible. They become distinguishable under culture in certain nutritive liquids, through peculiar forms of aggregation, through rapid multiplication by division, and through the products of their growth. This growth is due to the absorption of the nutritive fluid, and to the subsequent elimination of waste material.

In a state of rest the moners appear as minute globular corpuscles, either undiscernable to the naked eye, or merely the size of a small pin head, as before stated. Their faculty of executing movements takes place through the protrusion of irregular fingerlike protuberances from the slimy surface, or of fine radiating filaments or pseudopodia. The pseudopodia are simple, immediate continuations of the structureless albuminous mass which constitutes the entire body. We are not able to find in it differentiated parts, and we can make the direct proof for the absolute homogeneity of the semiliquid albuminous substance by observing them under the microscope in the act of taking food. If minute bodies, acceptable to their tastes, such as comminuted organic substances or infusory animals, come into actual contact, they adhere to the sticky surface and create an irritation. In response to this an increased flow of the slimy substance toward that particle takes place, which ultimately incloses it. Sometimes a funnel-shaped depression forming in the moner serves the same purpose. The nutriment is thereafter digested by diffusion (endosmosis) and what is left unabsorbed brought to the surface again in a corresponding way. Equally simple is their mode of propagation, which is asexual or by monogamy, and consists simply in self-division. Whenever such a minute body acquires a certain size from sufficient nutrition, it parts into two pieces; an annular constriction forms first, and the division is soon complete.

In other species, like *Vampyrella* and *Gloidium*, the body divides into four equal parts; in *Protomonas* and *Protomyxa* the body at once resolves into a great number of globular spherules.

Here, like elsewhere, when science transcends the limits of the perceptible and the domain of experience, venturing into the dark field of the unknown, the investigator must ultimately be guided by an ingenious use of the imagination; of that wondrous faculty which, left to ramble uncontrolled, leads us astray into a wilderness of perplexities and errors, a land of mists and shadows; but which, properly controlled by experience and reflection, becomes the noblest attribute of man, the source of poetic genius, the instrument of discovery in sciences, without the aid of which Newton would never have invented the fluxions, or Davy have discovered the earths and alkalis, nor Roentgen the X rays, nor Columbus have found another continent.

The clearest and best elaborated hypothesis about organic states preceding the moners is given by Karl von Nägeli in his great work, "The Mechanico-physiological Theory of Evolution" ("Mechanisch-physiologische Theorie der Abstammungslehre"), Munich and Leipzig, 1884.

Before entering upon the micellar\* hypothesis of Nägeli, it may be well to state that Haeckel had made distinction between those "Beginnings of Life" based upon the mode of nutrition, as phytomoners and zoömoners. The first are built up from protoplasma, possessing the faculty to prepare plasson synthetically from inorganic matter, converting the living force of sunlight into latent chemical energy of organic combinations.

The other class, or zoömoners, are plasma eaters, consist of zoöplasma and cannot transmute inorganic matter into plasma. They live upon the plasma of the preformed phytomoners, and convert the therein contained energy again into heat and motion. To the phytomoners belong the Chromaceæ, and also the hypothetical, oldest originators of all organisms,

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\*Micella, diminutive of mica, a grain, crumb, a cell, or assumed intermediate state between a molecule and a cell.

the Protobiens. He defines them as very minute, living plasma-granules proceeding from micellar organization. Nägeli thinks that these bodies are too minute to become distinguishable even under the highest powers. To be more explicit I quote three paragraphs from Nägeli's work, referring the reader to the original work :

“ Certain organic compounds, among them albumen, are neither soluble, despite their great affinity for water, nor are they fusible, and hence are produced in the micellar form. These compounds are formed in water where the molecules that arise immediately adjoining each other arrange themselves into incipient crystals, or micellæ. Only such of the molecules as are formed subsequently and come into contact with the micella, contribute to its increase in size, while the others, on account of their insolubility, produce new micellæ. For this reason the micellæ remain so small that they are invisible, even with the microscope.

“ On account of their great affinity for water the micellæ surround themselves with a thick film of it. The attraction of these micellæ for matter of their own kind is felt outside of this film. Hence the micellæ with their films unite themselves into solid masses permeated with water, unless other forces overcome attraction. The internal and external constitution of micellar bodies depends essentially upon the size, form, and dynamic nature of their micellæ, since on these factors depends the original arrangement of the micellæ, and the insertion in proper order of those formed later.

“ The micellæ of albumen or plasma are susceptible of the greatest diversity of form, size, and chemical composition, since they originate from unlike mixtures of various albumen compounds, and besides are mixed with various organic and inorganic substances. For this reason the plasma behaves, both chemically and physically, in many unlike ways, and in consequence of the variable relation of the micellæ to water, the plasma shows all degrees of micellar solution up to quite solid masses. Within the plasma masses the production of albumen goes on more easily under the influence of their molecular forces than in the liquid without. Hence the compounds present in the organic substratum and capable of forming

albumen enter preferably into the masses of plasma, and by intussusception of micellæ of albumen cause growth. Here life exists in its simplest form."

Spontaneous generation presupposes the origin of plasma-micellæ from molecules, hence cannot be brought about by solutions from albumens or peptones, since these are micellar solutions. Life presupposes the intussusception of plasma-micellæ; hence it ceases as soon as the arrangement of micellæ is so far disordered by injurious influences as to render that process of growth impossible. The resulting organism must be perfectly simple, a mass of plasma with micellæ as yet unarranged, because any organization without a preceding organizing activity is inconceivable. For this reason known organisms cannot have originated spontaneously; a kingdom of simpler things must have preceded them. '(Probiens—the suborganic kingdom.)

Haeckel ("Natürliche Schöpfungs-Geschichte," Vol. II., pages 430-431) says: "I believe, with Nägeli, it is very probable that the like acts of spontaneous generation have repeated themselves very often, invariably when the necessary conditions emerged in the inorganic nature. They may even occur now, daily, without our being able to observe them directly with our inadequate methods of research. We are entirely unacquainted with those conditions; and the spontaneous origination of minute probionts, of minute plasson-granules, which elude discovery even with the highest magnifying powers, may fail to be demonstrable even amid the best chances. In reference to the contemporary moners we have the choice between the following conclusions: Either they descend, indeed, directly from the first originated (or created) oldest moners, and then they must have propagated and preserved themselves, since many millions of years in the original form of minute, simple, plasma corpuscles, or the moners of the present day have come into existence in the course of the organic evolution of the earth, by repeated acts of spontaneous generation, and then there is no physical obstacle imaginable, why it should not be repeated infinitely often."

Pending this question the reflection is forced upon us that in those immemorial prææval times, terrestrial conditions ex-

isted, quite different from those of the present day, which may have facilitated autogony.

The organic history of this globe must have had its beginning in an age when the oceans were united, forming an uninterrupted surface, and the temperature of the waters sufficiently decreased to allow the formation of albuminous compounds. This may have been not far from the boiling point, as we even now find living organisms in natural springs of high temperature. I picture in my fantasy the incumbent atmosphere charged with irrespirable gases, filled with immense masses of vapors inclosing the ocean in impenetrable darkness, which was relieved only by the diffuse phosphorescence of floating luminous corpuscles; the waters charged with mineral solutions, ready for precipitation with progressing refrigeration; the sky luminous from uninterrupted electric flashes; and the atmosphere trembling from incessant pealings of thunder, and whirled about by furious cyclones.

Then already may possibly the hot waters of the primordial oceans have been peopled by living beings. Their high temperatures may even have been favorable to their coming into existence, as we even nowadays find oscillatories and algæ in hot springs at  $140^{\circ}$ . In the geysers of Yellowstone Park live *Conferva major* and *Phormidium laminosum*, flourishing by  $162^{\circ}$  to  $176^{\circ}$ , while the albumen of the higher organism coagulates at  $162^{\circ}$  Fahr. As there is reason to believe, as above stated, that the surface of the globe was shrouded in darkness, or only illuminated by diffused light, until the sun broke through the clouds, we must take into account that the gelatinous bodies of the schizomycetes and algæ of this time contained a bluish green substance; the phycocyanin in diffusion through their bodies, whose carbon-absorbing function was not confined to any granular or cellular formation, like the chlorophyll, which came into existence afterwards with the higher vegetable forms and for whose action a weaker illumination sufficed.

It is a permissible speculation that the enzymes or formless ferments may have played an important part in the genesis of life. We have long known of a number of albuminous, soluble substances which chemists called "enzymes," or

shapeless and formless ferments, which, like yeast—a well-known organized ferment—excite fermentation in organic solutions and cause the splitting up of their molecular structure, without experiencing an increase of their own volume. By this they imitate or replace the vital action of the formed fermenters.

Judging from the ordinary standard those shapeless bodies would be considered as lifeless; yet it is very doubtful if they should as such be held, for they develop properties in common with those of the living ferments. Whenever the solutions of these enzymes are exposed to temperatures of 160° to 210° they become inefficient just as well as the organized ferments. They are also killed by alcohol, corrosive sublimate, and all the substances which destroy the vitality of the bacteria. Thus is established a difference between living and dead enzymes.

Recently an experiment was made by Buchner, to obtain under high pressure a juice from living ferment-organisms, with subsequent filtration. The fluid prepared in this way has had the same effect, like the living structural ferments.

Thus we are led to conjecture a still lower grade of vital processes, some kind of chemical life which eludes our microscopical investigations.

The immense quantities of carbon now deposited in the devonian and carboniferous strata and the oil-soaked limestones and sandstones of the silurian, circulated as carbonic dioxide, mixed with sulphureted hydrogen gas. Immense periods may have passed before the rays of the sun broke through the clouds, before chlorophyll-bearing tissues could proceed to deurate the air of the carbon. The geometric regularity of the organic forms of that era, the protophytæ (diatomaceæ and cosmariaceæ), and of the protozoa (radiolariæ) and the large percentage of mineral matter, silica, and carbonate of lime, contained in their texture, give them a great resemblance to certain systems of crystallization—snow-flakes or augitic forms of crystals.

The doctrine of protoplasm as advanced by Huxley and the recent success in synthetic chemistry in the production of some organic compounds, like urea or indigo, hold out the

promise of the manufacture of living matter by artificial means. Yet none of these numerous laboratory products has reached the quality of protoplasm—a substance endowed with the self-evolving power of continuous change.

All the artificially produced proteids are definite and homogeneous chemical compounds, without that fundamental organic characteristic of a definite external limitation.

Bacteria and moners are without recognizable internal structure, but greatly specialized in size and shape. Even they show functions of psychical force, be it only the selection of food.

From these lowest forms onward we observe with increasing clearness the organic progress—irritability and growing diversity of structure, sexuality, sensibility, more and more specialization in digestive, reproductive, and nervous systems, and ultimately the intellectual or psychical faculties.

The continuity of evolution represented in the succession of species is rerepresented in the genesis of individual lives by embryonic development, when during fetal life the ancestral stages are gradually passed through, a process proving the validity of the laws of inheritance and adaptation—ontogeny.

At this point we are brought in contact with the highest problems not only of biology, but also of philosophy, the psychical question.

The individual existence of organisms takes its beginning in the moment of fertilization of the ovum, through the microscopically small spermatic cell. An important discovery made recently by Pfeffer demonstrated that the mutual attraction between the spermatozoa and ovum is effected by chemical affinity. No other act in organic life demonstrates more convincingly the importance and efficiency of matter, when we contemplate how the physical and intellectual development not only of the newly generated being, but also of his descendants, for indefinite time is thereby predetermined. The minuteness and simplicity of the external structure of this cell demand an indeterminable complicity of its molecular composition.

Indications of a psychical energy are noticeable at a very low

stage of organization. M. Romanes, in his zoölogical scale, assigns the first manifestations of surprise and fear to the larvæ of insects and annelids; but according to A. Binet this emotion is proper also to infusories. If a drop of acetic acid be introduced beneath the glass slide in a preparation containing quantities of infusories, the latter will at once be seen to flee in all directions like a flock of frightened sheep.

Möbius thinks that memory is one of the most elementary and primitive psychological facts, already observable in the ciliated infusories. He properly remarks that every time an animal repeats the same action under influence of the same excitation that fact proves that the animal is possessed of memory. According to Verworn even rhizopods are endowed with primary instincts, as he demonstrates in the conduct of the *Diffugia urceolata*, which constructs an envelope out of sand particles for its offspring, before it passes out of its body by division.

To find such complete psychical activity in the history of these low organisms becomes less surprising when we call to mind that, agreeable to the idea of evolution now accepted, a higher animal is nothing more than a colony of protozoans. Every one of the cells composing such an animal has retained its primitive properties, giving them a higher degree of perfection by division of labor and by selection. The epithelial cells that secrete the nails and the hair are organisms perfected with reference to the secretion of protective parts. Similarly, the cells of the brain are organisms that have been perfected with reference to psychical attributes.

I wish to close this sketch of protoplasm with some remarks on the mechanism of the cerebral functions and ultimate inferences in reference to the psychical problem.

Considering that the human cerebral mass, weighing 34 pounds, consists of material of the most impressible and versatile molecular composition, with the supra-addition of an immensely complicated structure, with a supply of blood for its nutrition and repair, amounting to one-third of the supply for the whole body, it is evident that a motor center is provided, able to evolve great effects.

Microscopical cerebral anatomy and psycho-physiology

have within the last twenty-five years reached important results. The differentiation and localization of the motory, sensitive, and intellectual functions has been determined. It is estimated that the gray or cortical substance contains from 500 to 1,000 millions of ganglia or cells, each of which emits from 5 to 10 nerve fibers to receive external impressions and to intercommunicate them. Thus we see a field of action which the most vivid fantasy could not survey.

I venture, with some diffidence in my ability to essay in a short sketch the mechanism which combined with the physico-chemical processes effects those cerebral functions which we comprehend as psychological activities, consciousness and reason.

The speculative or metaphysical procedure has from the remotest days to this time always been attempted in two totally different and opposite ways. The dualistic, accepting two elements, body and soul, whereby the body presides over the vegetative and animal functions and the soul exercises the hegemony over all the intellectual faculties, retaining its self-consciousness and permanence after its separation from the body by death.

The other, or monistic, view declares for the inseparable unity of both, and, repudiating the intrusion of dogmatic elements as parts of argumentation, defends its position by means of the exact natural sciences, facts sustained by anatomical dissection, the microscope, and psychological experiment.

From this source we know that the faculty to think and to move depends upon the intact state of nervous cells and fibers, and that the entire psychology is identical with the anatomy and physiology of the nervous system.

We know now with considerable detail how the contact of the sensual organs with the outer world produces specific sense activities, to be conducted along linear paths, the nerves and nerve fibers and fibrils to the brain, in whose different departments the peripheral perceptions are elaborated into intellectual concepts.

But few years ago it was believed that nerve fibers emitted from the great hemispheres would, in uninterrupted continuity, extend to the outmost limits of the body, comparing the mind apparatus with an immense central station of a telephone sys-

tem, with millions of connections. The excitation of a peripheral terminal thus to be reported in the central station, whence again the elaborated volition would be sent out to a subordinate organ for execution.

This comparison is, however, not fully correct. The exact anatomy of the brain, as has been developed by the researches of Waldeyer, Flechsig and Ramon y Cajal, proves that the former view, accepting a division of the function of nerve fibers and nerve cells, was incorrect, and that neither does anywhere exist by itself; that there is no fiber without a cell, and reversely. The fiber is only the long-drawn-out end of the cell. The uninterrupted continuance is also a misconception. We observe how a decapitated frog executes movements of his legs to counteract the pricking of the skin of his back. From this it is evident that there are intermediate stations which in part, at least, supplant the cerebral action. Such stations or organs are called "ganglia." They are the governing seat of action by all animals not possessed of a cephalic cerebral system. Their actions are excited by irritation of sensitive fibers, and are purely emotional and sensational, and but little specialized functions. From such a ganglionic point the conduct is carried forward by other cells and fibers until the ultimate destination ends in the gray matter of the hemispheres of the vertebrates in a specially designated sphere. In sleep or in a state of rest the ends of fibrils float freely in the surrounding plasma, until a moment of excitation arrives, when the ends immediately approach each other, forming connection. Those links, serving as the transport of the excitations, are called "neurons" and the transmitting force is commonly called "animal electricity." The velocity of transportation has been experimentally tested, never to exceed from twenty-five to thirty meters per second, not exceeding the velocity of a rapidly moving express train. In the same space of time which elapses between the prick of a needle at the point of the index finger and its appearance in consciousness a telegram would cross the Atlantic. Neural and physical electricity must be forces of different kinds. Many of the nervous functions of the highest organizations are confined to the ganglionic systems, and fulfill within this circuit their activities

concerned in nutrition, circulation, respiration, and reproduction, and communicate only indirectly with the hemispheres, but directly with the spinal cord, medulla elongata, cerebellum, and corpora quadrigemina, which are the centers of the organic functions.

These divisions are fully developed in the newborn human infant and in perfect functional activity. Very different is at the same time the state of development of the hemispheres, which are the seat of the sense perception in intellectual activity. While an infant shows the liveliest interest in the means employed to gratify his physical wants, he remains in a state of intellectual imbecility for months, and years pass before he reaches maturity. The cause of this lies in the circumstance that in the gray substance of the newborn infant are, as yet, comparatively but few cells with extended connecting fibril ends. Not before the lapse of some time do also the corresponding nerve ends of the sense organs advance sufficiently to approach and come in contact with the cerebral fibers. First to develop are the olfactory, and at last the auditory nerves, to proceed from the base of the brain upward into the cortical sphere.

Although thus the psychical activities, with the awakening of consciousness, are herewith initiated, the sphere of volition is as yet very limited; for, as only one-third of the hemispheres are assigned to the reception of sense perception, in which the other two-thirds are not at all concerned, these latter remain yet for one whole month completely undeveloped, and are yet in no way connected with the other cerebral centers and conductive structures. Not before the regions of the special sense organs have completely finished their development, commences the evolution in those belated parts. It is now that millions of fibers extend from the sensual sphere into the other two regions to intercross with one another, to evoke all the muscular action, to combine with stored-up percepts and concepts, to execute all the manifestations of the intellect, to emit their command to every division of the body under the control of volition. These parts are called the association centers—the workshop of the mind.

The herewith presented theory of mind is based upon the

anatomical structure of the brain, and has been fully attested in the clinical practice as a satisfactory explanation of the cause of intellectual disturbances. It is the immense preponderance of the association centers over all the other cerebral divisions which secures the intellectual superiority of man over the highest intelligences of all other animals, in neither one of which a like relation occurs. Lesions, mechanical or pathological, in the association centers are the source of mental disturbances. Should conducting channels in any other part of the body happen to take place, anæsthesia or paralysis results in the affected parts, consciousness and intelligence remaining intact. Injury to the sensitive spheres produces loss of the respective sensual perceptions of sight, hearing, etc., but disturbances in the associated regions means intellectual aberration.

In respect to the evolution of the human brain and mind, the lower animals seemingly are at some advantage in achieving so soon after birth the faculty of taking care of themselves, and perfecting the cerebral integration in an incomparably shorter period than man does.

This apparent tardiness is, however, nothing more or less than a prolonged plasticity and long-continued receptivity for cell production and extension of association tissue and storage of sense and reflective impressions.

Other conditions being equal, it is the prevalence of this quality which conditions the differentiation not only between individuals, but also between the races. The dark-colored tribes attain to sexual and intellectual fullness much earlier, greatly to a disadvantage in regard to docility and training. Under this aspect I accept the view of Alexander von Humboldt on the differentiation of man: "Mankind presents a graduation into more docile, higher cultivated, through intellectual culture more ennobled, but not unconditionally nobler races. All are in the same measure destined to enjoy liberty, which in the more barbarous conditions consists in personal independence and in the civilized state, under the protection of political institutions, secures for all equal rights." Diversity of adaptation, conditions of climate accelerate or retard the social progress, but all have to struggle for its achievement under the slow and severe process of social evolution.

This is the physico-mechanical provision for the accomplishment of cerebral functions, as far as our present anatomical studies have made clear. The act itself of the conversion of molecular motion into consciousness, as well of things outside of us—objective consciousness—as also of the internal processes of self-consciousness in gradations of every degree, is yet an unsolved problem, tempting the inventiveness of the speculative mind.

The modern monism accords the origin of the whole universe to an absolute Unity and Essence whose quality the human mind has no means of investigating, which we aim to express as the union of matter, motion, and mind, three essential realities which never and nowhere exist separately, or as mere functions of one or the other, but are coexistent and universal.

Matter is the extended, space-filling, indestructible reality, subject to gravitation, appearing in three different aggregations—the solid, liquid, and gaseous—and in about seventy-six elementary forms. We recognize in the atom the ultimate divisibility of the chemical elements; in the molecule the limit of divisibility, without change of its chemical properties: in the advance of the combination of those molecules, first, the stable elements of the mineral kingdom; progressing in the scale of evolution, we advance to the multifarious and mutable hydrocarbon compounds, which are the substratum of the organic creation, the most complex of which are the proteids and albuminoids, which, while some of them may be artificially produced by synthesis, by still further recompounding appear as protoplasm, a living, organized substance, whose continuance depends on an uninterrupted exchange of its constituent molecules by the process of nutrition and elimination, and is subject to death and decay whenever this metabolism is suspended while it is in an active state of growth. It has been suggested by Lester Ward that the ultimate accretions of albuminoids to perfect the constitutionality of protoplasm is no longer dependent on chemical affinity, but follows the law of molar attraction or gravitation, and constitutes motility. This may serve to account for their extreme instability. Contractile tissue and muscular fiber follow.

The second reality is motion, or function of the ether, con-

sidered by physicists an "imponderable matter," of which we cannot form any sensual conception, and whose existence we deduce from its functions—light, electricity, magnetism, and radiant heat—which are mutually convertible energies and indestructible. We can only give it the attribute "ethereal," since it is not comparable with any of the qualities of ponderable matter. Ether is the supporter and transmitter of all modes of motion, the harmonizer of cosmical processes. Potential and actual energy, heat and electricity, are in the same constant play of alternations as the molecular chemism of the elements, and controlled by the laws of the preservation of energy and matter, and are always the same quantitatively.

As a third reality we conceive mind as a cosmic energy. In its action upon the psychic organs of organisms it effects consciousness, the idea of the ego, which, with its percepts, sensations, concepts, memories, desires, and volitions, we, by traditional acceptance, know as the soul, a metaphysical entity, and which we have been taught to consider as different from the body, although with widely differing opinions as regards their mutual relations.

This cosmic mind can possibly have no semblance to the highest intelligence we know of, the human mind.

The human mind lives, so to speak, within a triple environment of its expansiveness.

We are aware of the outer world by sensual perceptions, out of which, in another cerebral department, the percepts are transformed into concepts, construed into thoughts and ideas, processes, which ultimately enable our reflective capacity to understand that what we think we know of the world outside of us is only a reflected image of the reality of things; but what all things may be by themselves, beyond the interpretations of our senses, we are utterly in the dark, without a ray of hope or probability of ever passing this limitation.

It appears to me that the cosmic mind, unlimited as we assume it to be in its expanse, must also be beyond all estimation, penetrating, knowing the inside of things as well as their outer appearances. The only revelation from the sacred Looks of the East we are assured to have been given concerning it, was given but once—to Moses on Sinai—in the words

“ I am that I am.” (The translation from the Hebrew as “ I am ” is not correct. It is meant: “ The essence I am ”—“ I am the true essence of things.”) The oldest of the Brahmanic sacred books, “ The Upanishads,” records a similar short sentence, which expresses the deepest meaning of their religious ideas: “ Tat tuam asi ”—“ Thy own self is the divinity.” The philosophies, both of Greece and of India, started before the days of Homer or Solomon from a common point—namely, from the conviction that our ordinary knowledge, depending upon the report of the senses, is uncertain and deceitful. Our knowledge according to Hindoo philosophers depends on two authorities—namely, sensual perception and deduction.

An infinite intelligence does not depend on our mind processes, on induction and deduction; it is the power of intuition, and its effect is causation.

I think it is not an illegitimate analogy to compare the functions of the brain with the respiratory process of the lungs. It calls for an uninterrupted vital process to maintain the blood corpuscles in a state of receptivity for the process of oxidation, on which depends the whole process of renewal and elimination. We know, on the other hand, that electric currents of measurable intensities are constantly generated in the whole nervous system, perhaps thereby producing the condition of maturity for the intussusception of the cosmic mind force manifesting itself as consciousness. The limitation of all individualized substances and the delineation of all forms in the organic and inorganic world and the persistence of inheritance of specific properties or qualities belong in the category of this mind force.

It pictures the flowery congelation of the watery vapor on the freezing window pane, prescribes the angles and corners of the forming crystal.

It may affect protoplasm in inconceivable paths to some kind of sensation in the plant, to emotion in the lower animals, and ultimately guide the intricate process of reasoning and light up to the highest spheres of our ideal aspirations. It stands in the same relation to the whole of the cosmos as self-consciousness does to plain consciousness, representing divine omniscience.

“Ob wohl Natur sich selbst erkennt?”

—Goethe, *Faust*.

May not Nature be self-conscious?

In rhythmic swells like ocean waves flows by the current of history. The past fifty years presented a period of unparalleled material progress in all civilized countries. The advance in mechanical and technical operations in transportation and production was so immense that they would necessarily imply a new valuation of human life. It is the outcome of the progress of the natural sciences. The measure of its value can only be taken by a parallelization with moral progress, on which rest the security, peace, and happiness of society. The evident disproportion in these two kinds of advances is due to the different nature of motor forces, the realistic or materialistic on the one side, and the idealistic on the other. Neither one is, of itself, either good or bad, and their efficiency depends upon the direction of the impetus with which they are started.

The materialist subjugates the forces of nature for material purposes, without definite reference to their bearing on the character and moral standing of the individual or the community. The character of this force is purely intellectual. It has an egoistic tendency.

The idealist is moved by sympathetic impulses. The psychical impulse originates in the sympathetic and allied nervous system; the intellectual sphere is a mere consulting—often a reluctant—aid. Sympathetic feeling is preëxistent: in the course of evolution it is very likely active before the development of nervous systems, and inherent to the unspecialized nerve matter. Its ultimate judgments and aspirations turn to the realization of the highest truth, goodness, beauty, and justice.

The realist finds the anchorage of his judgments in conditions as they are actually presented; the idealist forms transcendental estimates—how things ought to be—and judges them by this standard. The realist finds security in direct observation; the idealist is swayed by sentiment. The one operates with the intellect; the other, with emotion. Realism

consequently advances the sciences; idealism, philosophy, religion, history. In the logical procedure realism proceeds inductively; idealism, deductively.

Never was, in a short interval of time, this division of psychic energy more clearly defined than in the teachings of Plato and Aristotle—men of such eminent wisdom that their axioms remained as guiding stars for these two factions of philosophy for twenty centuries.

It seems to fit the occasion to explain the principal attitudes of mind, instinct and intelligence.

In his work on "Origin of Species," Darwin gives the following definition of instinct: "An action which we ourselves should require experience to enable us to perform, when performed by an animal, more especially very young ones, without any experience, and when performed by many individuals in the same way, without knowing for what purpose it is performed, is usually said to be instinctive. As all instincts show a trace of selective qualities, a trace of reasoning power has also to be conceded, even to the lowest ones." He further qualified this tenet by the following doctrines:

1. The instincts of the species differ with individuals, and are in the same way subject to variation as are the morphological marks of bodily formation.
2. These variations are by inheritance in part transferred to the descendants, and in the succession of generations accumulated and confirmed.
3. Selection (artificial as well as natural) exercises amongst these hereditary variations of vital activities a preference in continuing the most useful and abandoning the less suitable modifications.
4. The divergence of physical characters, thus originated, leads to the continuity of succession in the same manner to the origin of new instincts as does the divergence of morphological characters produce new species.

The scholastic mediæval psychologic views—which even yet have adherents—made an absolute distinction between the psychical activity of animals and man, calling the former "instinct" (implanted) and the latter "reason," judging that, according to the Mosaic history of creation, every species of ani-

mal received a certain measure of intelligence, just sufficient for its protection and maintenance. The latter opinion we find plainest expressed in the works of Thomas ab Aquina, a mediæval saint and celebrated doctor of theology, and interpreter of the works of Aristotle.

It is generally believed that instincts are infallible guides of action. This is, however, far from being true to its full extent. They often lead to great injury to the individual, and even destruction of large masses. They are sufficient only for the maintenance of the species in the lower orders, who dispose of an immense reproductivity. A phase of selective action, the germ of reason, is, as above mooted, traceable very early in the course of evolution. A similar relation is manifest also in the unconscious (not instinctive) actions of man. The execution of, for instance, a sonata may pass on in a dormant state of reason, as far as memory of melody, but the expression of pathos or affection must be rendered in full consciousness or the performance will be a failure.

Of instincts there are innumerable varieties—as many, indeed, as there are species of animals. All may be distinguished on two fundamental principles, as primary and secondary.

Primary instincts are the general lower impulses, which from the beginning of organic life existed in the unconscious state of the "psychoplasma" as inherent qualities—self-preservation (protection and nutrition), and propagation (coitus and rearing of the young). These two fundamental motors of organic life, hunger and love, have originated unconsciously, without the access of reason or intelligence, but have afterwards, in the course of evolution, by man and the higher animals become objects of consciousness.

A reverse relation governs the secondary instincts. These have primarily come about by intelligent adaptation, by rational thinking and reflection, and by appropriate conscious action. Gradually they became habitual and unconsciously effective, and appear now in the descendants through inheritance as congenital qualities.

The first authorities in physiology and animal psychology have now arrived at the nearly uniform agreement that there is no qualitative, but only a quantitative, difference be-

tween the souls of men and animals. The movements, desires, and actions, from the lowest to the highest, are determined by antecedent physiological states. The changes which at each moment take place in consciousness are produced by an infinitude of previous experiences, registered in the nervous structure, coöperating with the immediate impressions on the senses; the effects of these combined factors being in every case qualified by the physical state, general or local, of the organism.

The current tenet respecting the freedom of the will is "that every one is at liberty to do what he desires to do." All admit this; however, the real proposition involved in the dogma of free will is, whether every one is at liberty to desire or not to desire. The mainspring of desires, the physiological state, has to respond to the solution of this question.

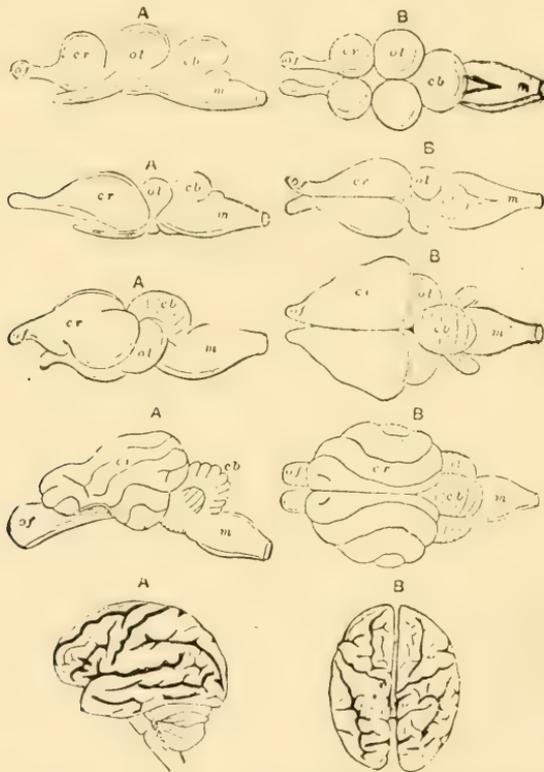
Herbert Spencer expresses himself thus: "Psychical changes either conform to law or they do not. If they do not conform to law, any work on psychical inquiry is sheer nonsense; no science of psychology is possible. If they do conform to law, there cannot be any such thing as free will."

The intellectual expression of the will we find in its influence on consciousness. The normal state of consciousness supposes diffusion, with the work of the brain diffused. The will can localize the work of the brain to special regions, or it may affect different elements, spread through the mass of encephalon, to a working in harmony, to the exclusion of the others. This attitude of the mind constitutes attention. Consumption of stored-up energy is called in aid for the perfection of this effort, which is only transient and soon brings about relaxation. This is the culmination of mind energy.

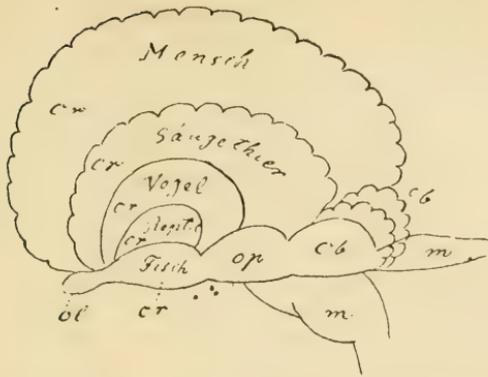
As the greatest multitude of vital actions are ever-returning repetitions of actions of the same quality, they become habitual, instinctive, unconscious. The combination of the mind elements subserving these unconscious actions constitutes the instinct mechanisms of the brains. That such instinct mechanisms direct not only the actions of the lower animals, but also the higher organisms, including man, we daily experience in the process of training, through which we convert intellectually-conceived actions into unconsciously-

transpiring ones. Such actions are walking, riding, singing, speaking, piano playing, and almost all intellectual actions. These acquired unconscious faculties are not transmissible to descendants by inheritance, although this had been the process by which instincts had originally been built up.

The inherited mechanisms of instinct have, in the course of evolution, been superseded by an organ of educability, the evolution of the organs of the mind, the great hemispheres of the brain. The annexed diagrams give a graphic illustration of the gradual expansion and preponderance of the intellectual over the vegetative, purely instinctive, reflex, and emotional organs and functions.



Comparative sketch of cerebral structure of Fish, Reptile, Bird, Mammal, and Man, viewed laterally (A) and from above (B); *of*, olfactory; *cr*, hemispheres; *ol*, corpus callosum; *cb*, cerebellum; *m*, medulla oblongata. —After Le Conte.



Schematic illustration of the cerebral increase by the different classes of vertebrates, projected in supraposition : *ol*, olfactory lobe ; *cr*, cerebrum ; *op*, corpus callosum or median sphere ; *mensch*, man ; *säugethier*, mammal ; *vogel*, bird. (The median sphere progresses in evolution in complexity of structure and increasing number of component elements.)

Satiated (as we now are, almost) by the daily recurrent gifts of inventive genius, and influx of material riches, we stand listening on the shore of time, and watching, for ear and eye perceive a new swell and the distant rumble of another wave, the first ripples of which indicate its idealistic nature, and indicate the demands of the era of the twentieth century.

The peace conference at The Hague, the parliaments of religion, the societies for ethical culture, have initiated these movements: Universality and unity of religious sentiment, that cannot be dismembered by commanding dogmas; pacification of the conflict between capital and labor by legally limiting the aggressiveness of either; defining on statistical estimates the share of labor in the net profits; a stronger government with relinquishment of the policy of leniency and hesitation which only serves to embolden violent and obstreperous characters, and encourages them to deeds such as have now cast the whole nation in grief and distress; the remotest of the Aleutian Islands to be chosen as a place of exile for dangerous criminals; deliverance of the educational system from ecclesiastic supervision, and the organization of its administration intrusted to a commission, selected from the professors and lecturers in the universities, technical schools, and art schools, with authority to make appointments and designate

the courses of instruction. In view of the fact that all doctrines, including theology, have to incorporate into their teaching the results of the natural sciences, as under their discipline alone correct thinking can be acquired, science teaching should on an appropriate scale be attempted in all grades. Abandonment of the missionary invasion commends itself on pleas of equity and prudence. Bold persistence in the traditional practice would provoke a permanent and irreconcilable conflict. Should the Eastern nations be considered amenable to the practices of the international code, they must be met on terms of complete political equality, as the disquieting introduction of dogmas alien to their national character, religious and political institutions born of the most ancient lineage in the world, must naturally appear to them as an unbearable imposition.

The comparative study of religions—Brahmanism, Buddhism, Parseeism, Mohammedanism—has proven that the elements of pure ethics are the same in all, and like in Christianity, and that errors and abuses have, from human depravity, equally corrupted all, and that in the progress of time with a strictly scientific theosophy a harmony could be effected.

Our own grievous sectarian ebullitions are sorry witnesses of the intellectual neglect and stifling influences of dogmatic superstitions. Those movements are also idealistic waves, but—alas!—of the briny flood that ruins fertile fields by its overflows.

Creeds, brought down from hoary antiquity as symbols of pristine religious sentiment, do no longer express the more exalted attitude of present generations toward the eternal and infinite, and reasonable and honest theologians are acknowledging the right of pure reason to subject to criticism the fountains of those creeds, and the so-called higher criticism is the result.

Epochs of history do not follow now in such tardy succession as they did in ancient time and still do in uncivilized regions, and the coming generation will not have gone into its grave when the portentous commotions produced by the present idealistic wave will have subsided in compromises and new financial and economic methods.

Thus the floods of ideas will swell and sink as long as the deeds of men make history.

At the Tennessee Centennial in 1897 I attended the Liberal Congress of Religions and joined in the Lord's Prayer with the Hindoo, Parsee, Mohammedan, and Jew. I felt deeply impressed by the simple service, but from the absence of the ministry I became aware that the morning star of the union of religions was, for this latitude, yet below the horizon of sectarian strife.

Constitutions of minds and ways of life differ amongst men immensely. The increasing acceptance of demonstrable facts may gradually effect a better understanding, and ultimately reconcile the still invincible adherents to tradition. The frame of mind which prompted my philosophy has come to me by way of my professional calling, and my early acquired habit of pursuing botanical studies, by which I learned to look, not only to the flowery side of things, but also to their roots and fruits, and which removed me more or less from the fictitious aspirations and pretensions of society.

My travels had no semblance with the rambles of the roaming nomad, who prostrated himself before the phantom of the burning bush and received a mission for conquest.

My path was lighted by a milder sun; it led over humming and blooming meadows to the silent forest, where a friendly Dryad received me into her shade, inviting to musing repose. She interpreted to me the sounds of the rustling leaves, the chirping of the cicada, the melody of the sweet songsters, and enjoined me to search and reason.

Was kann der Mensch im Leben mehr gewinnen  
Als dass sich Gott Natur ihm offenbare? —Goethe.

Life's greatest glory is that mind  
In Nature God revealed may find.

As in a dream it came to my thoughts that the charming picture spread before me was the effect of the alternation of light and color, and that no object could be visible unless it cast a shadow; that all evils that oppress earthly life are the necessary consequences of individualization and differentiation in the organic world; imperfection to be the condition

under which alone individuality is granted: perfection to be alone the attribute of that infinite reality who, divesting himself of his all-embracing personality, assumed the garb of the cosmos and endowed it with intelligence and love, beauty and justice, to adjust its inequalities in the process of evolution.

As the dewdrop reposing on the grass blade, glittering in the morning sun, reflects the splendor of the heavens and the image of the horizon, until with the rising day it disappears, dissolving in the air, thus the light of philosophy pictures the image of ideas on a film of protoplasm.

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