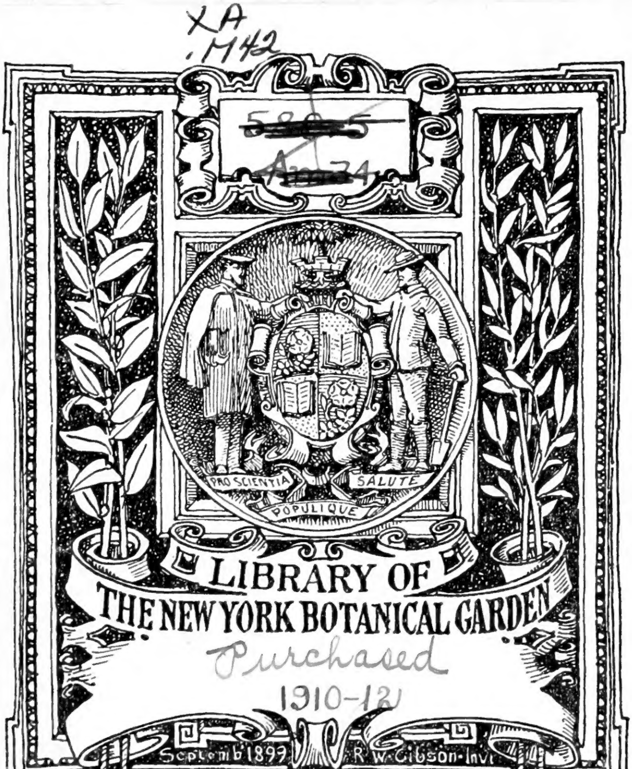
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THE AMERICAN BOTANIST

DEVOTED TO ECONOMIC
AND ECOLOGICAL BOTANY

EDITED BY WILLARD N. CLUTE

Volume XVI

JOLIET, ILLINOIS
WILLARD N. CLUTE & COMPANY
1910

CONTENTS

CONTRIBUTED ARTICLES.

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NOTE AND COMMENT.

VOLUME 16, NUMBER 1 WHOLE NUMBER 84

FEBRUARY, 1910

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CONTENTS

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JOLIET, ILLINOIS

The American Botanist

A QUARTERLY DEVOTED TO ECOLOGICAL AND ECONOMIC BOTANY

WILLARD N. CLUTE ❯ ❯ ❯ EDITOR

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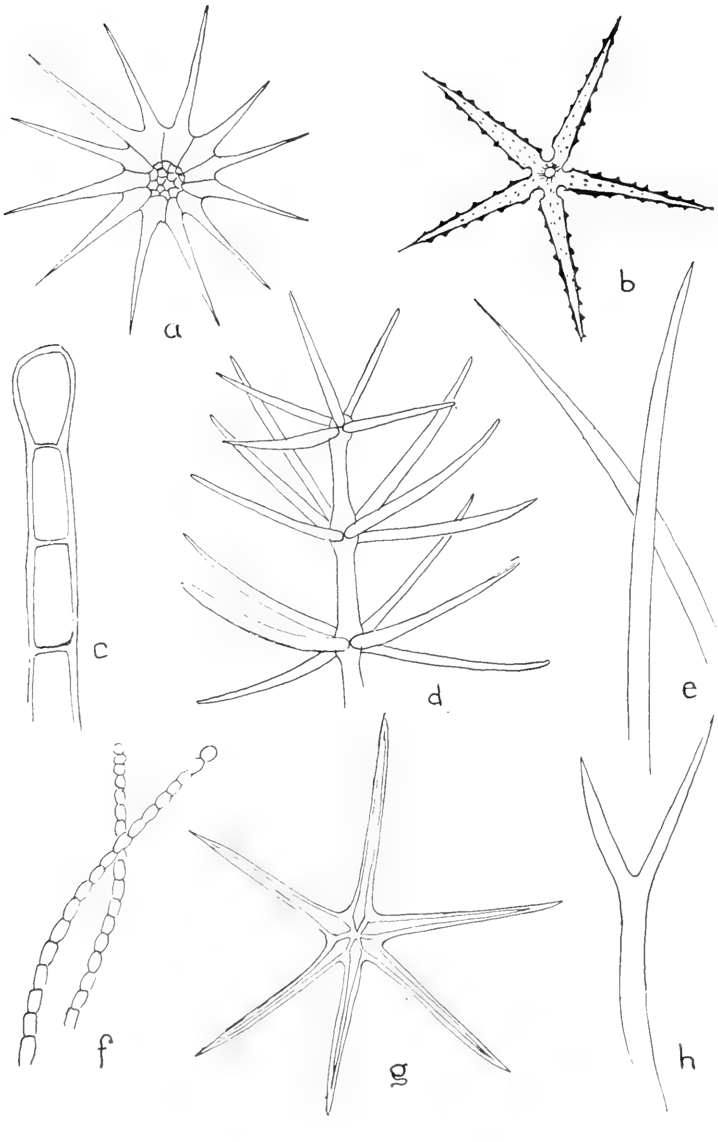


PLANT HAIRS AND SCALES.

THE AMERICAN BOTANIST

VOL. XVI JOLIET, ILL., FEBRUARY, 1910 No. 1

Soon o'er their heads blithe April airs shall sing,
A thousand wildflowers round them shall unfold,
The green buds glisten in the dews of spring,
And be all vernal rapture as of old.

—**Keble.**

SOME SPRING WILDFLOWERS OF ALBERTA.

By W. M. Buswell.

NEAR the big bend of Battle River one of the first flowers to appear it the little pasque-flower. If the Spring is early the first ones are seen early in April but perhaps the next year they will not be seen before the first of May. For several days before the first flowers appear, little balls of gray fur may be seen all over the prairie where the pasque-flowers are starting from the ground. These are soon followed by the pretty bell-shaped bluish, lavender or sometimes pink flowers. They are 3 to 5 inches high, the involucre and stem covered with grayish hairs. As they grow older the flowers grow upward on pedicels nearly as long as the main stem leaving the hairy involucre where it was when the flower first opened. In about a week or 10 days after the first flower appears the prairie is covered with them and the much divided leaves are beginning to appear on the earliest ones. When they are in full bloom the prairie looks like a large flower garden. Later when in fruit, the long feathery tails on the fruit colors the prairie a nearly uniform gray. They are generally called crocus flowers by the people here and I believe the name crocus amemone has been suggested for them thus combining the botanical name with the name by which they are commonly known.

A few days later the next common flowers appear—two members of the parsley family *Peucedanum villosum* and *P. nudicaule*—they do not appear to have a common name. *P. villosum* is much more common than the other, growing in nearly all bare spots in what is called gumbo soil where very few other plants will grow. The umbel of yellow flowers on stems 3 to 8 inches high from the root resembles the flowers of the early meadow parsnip. There are two or three finely dissected leaves from the root usually spreading out or lying flat on the ground so that the flowering stem stands up above the leaves. *P. nudicaule* is usually found growing in thick grass along the river, the flowers are white and the leaves much thinner.

Phlox Hoodii is another common plant in bloom about this time. These are small, stiff, pale green plants, like a spruce twig, two or four inches high, with numerous small, white, five-petalled flowers. Sometimes there are so many flowers on a plant that they form a thick mat three or four inches in diameter when they are quite showy.

The two species of buffalo-berry are in bloom now, but the flowers are not conspicuous, being in small close clusters around the stem, the staminate and pistilate on different plants. On the Canadian buffalo-berry the leaves are the most showy part of the plant at this time, the two rusty-backed leaves at the end of each twig lightly folded together, look like rusty spear-heads sticking out in all directions.

Following these, all damp rich spots on the prairie and along the sides of coulees, begin to grow yellow with large patches of the prairie thermopsis (*T. rhombifolia*) resembling patches of dandelions in bloom as we see them in the East. They are one of the most showy flowers we have here, the plants growing from 4 to 5 inches to a foot high with trifoliate leaves and racemes of large deep yellow pea blossoms at the end of the leafy stems.

The yellow oxytrope *O. campestris* is in bloom at the same time, also growing in large patches but much different in appearance, the leaves are pinnate, with about 17 pale green leaflets, the pale yellow flowers are smaller than those of *Thermopsis* and in a more compact head on naked stems, but as there are often from 10 to 20 flower stalks on a plant standing up above the leaves they are very showy. The oxytrope seems to prefer dry stony or sandy banks where the grass is thin, so the two are not often found growing together.

In early May the first woodland flowers begin to open and something new is seen nearly every day. We have several different violets here, some of them new to me. The Canada violet was not a new one, but I had never seen them growing as large and in such numbers before. Nearly every coulee has one or both sides covered with a growth of poplar, balm and white birch trees with an undergrowth of shrubs of different kinds and the ground is carpeted with Canada violets in bloom until cold weather in the Fall. Nuttalls violet is the only yellow species I have found here, usually growing on banks along the valley.

From the time the first pasque-flower opens in the spring until late in the fall there are flowers everywhere, in the small groves of poplar and willow on the prairie and along the river as well as all over the prairie, but there are very few sweet scented flowers at any time. Of the early flowers the sweet coltsfoot is about the only sweet scented species.

Through the winter when the trees and shrubs are leafless and most flowering plants are dead or merely dry stalks, about the only green to be seen is a large patch of bearberry here and there along the high banks near the river or on the banks of a coulee, nearly always near the top. About the middle of May they are covered with little bunches of bottle-shaped flowers which look like small white lamp chimneys with the turned back tops a deep rosy red. These are followed by large red berries, more ornamental than useful, as they are filled with large seeds and are rather dry when ripe.

I think there are fewer species of early flowers here than in the East but through June, July and August there are more flowers than I have ever seen in any one place in the East, many of them very attractive, especially those of the pulse family and some of the composites.

PLANT HAIRS AND SCALES.

By Mary McGowan.

MOST people have doubtless noticed the hairy or downy coating on the leaves, and stems of various plants, but few have stopped to consider their structure, or realized that many are not mere simple hairs as we would naturally suppose, but may be foked, branched, many celled, and even with the cells arranged in rosettes to form scales.

It is a noticeable fact that plants having such structures are generally found growing in sunny places. The advantage of the hairs in this case would be to retard evaporation by shading the leaves from the sun. In most cases the hairs also seem designed to protect the stomata or breathing pores from being clogged by rain or dew, and still another advantage is that they protect the plant from sudden changes of temperature.

The epidermal hairs are also of use, in another way. Animals seeing the hairy surface of a plant will turn away from it, if they have tried to eat it before and if not they fail to eat very much on account of the prickly sensation produced on their tongues by the hairs. The branched hairs of the Mullein are especially useful to the plant, as it flourishes everywhere along roadsides, in pastures, and in the woods and other waste grounds, where it is exposed to injury on all sides.

Some of the most interesting of epidermal structures are the scales of such plants as *Shepherdia* and *Deutzia*. In those of *Shepherdia* (fig. a.) the several cells are arranged in a rosette while in *Deutzia* they are star like and have a toothed edge. Some are five parted, and others eight parted, with rounded points scattered throughout. The geranium has two different forms of hairs, namely the simple (fig. e), and glandular (fig. c). These are not confined to any special part of the leaf. They are intermixed. The simple are one celled hairs, with very sharp tips. The others are many celled, and have a globular cell at the tip which is glandular. This cell gives out a fragrant oil that is so familiar to us, when the plant is bruised. The hairs of the mullein are rather more complex than any I have mentioned because they are not continuous in one direction, but each small hair seems to be jointed to a large central hair, the smaller hairs, six in number, joining the central hair at regular intervals, and forming a circule around it. The tip of the hair is globular in shape, and has one celled hairs projecting from all sides. In the Dame's violet (fig. h) the hairs are forked instead of single, forming two sharp points. This saves space, and does twice the work of the simple continuous hair. The epidermal hairs of the Hollyhock are very symmetrical in shape having five regular parts, radiating from the center, and a sheathlike cell at the base binding them together. The stamen hairs of *Tradescantia* are the most peculiar of all hairs previously mentioned. They are large oval cells joined together forming a hair, and those near the tip are rounded, the whole structure resembling a beaded necklace.

Joliet, Illinois.

THREE EXAMPLES OF RETARDED DEVELOPMENT AMONG LEAVES.

By Edwin W. Humphreys.

VARIATION in leaf form is an exceedingly interesting field for study. Even a cursory examination of a plant will often reveal some remarkably shaped leaves. Besides what may be called normal or expected differences in shape,

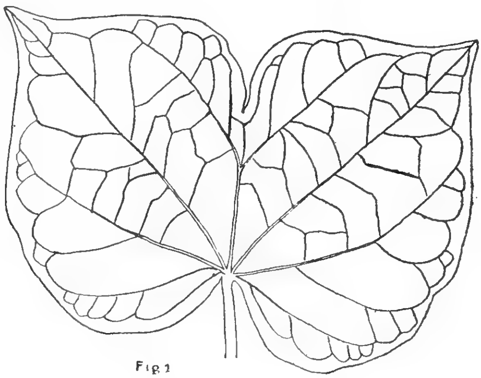


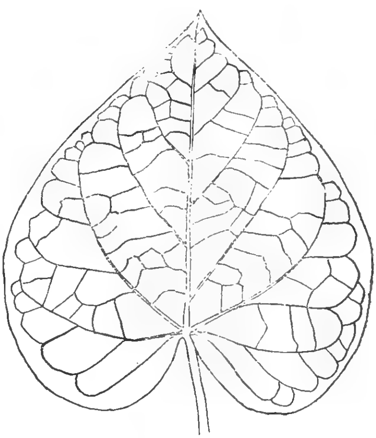
Fig 2

as in the case of the sassafras, mulberry and others, there are often to be found strange and unusual forms. It is to some of these peculiar forms that attention is here directed.

The most remarkable of the three examples occurred on the common garden morning-glory. While removing some dead and withered leaves from certain plants in my garden, the leaf illustrated (fig. 1) was found. To one familiar with the seedling morning-glory of this variety the cotyledons are irresistibly called to mind. The figure (fig 2) shows the shape and nervation of the cotyledon, so that the reader may compare it with the later, unusual leaf and note their essential similarity. It is because of this similarity that the large leaf is looked upon as a retarded or atavistic form; one which, though mature and appearing at a later period of growth of the plant, has not developed beyond the stage represented by the cotyledon. On the other hand, its great difference from the normal leaf of this variety of morning-glory may be seen by comparing it with figure 3.

Fig 2.

In this case a single leaf only was involved, though several similar leaves were afterwards found on different plants. Sometimes, however, all the leaves of a given tree or plant are thus retarded As is well known, the first leaves put forth by the seedling sassafras are the simple, non-lobed forms, the lobed forms appearing later. This is also true of the individual branches, on each of which the lower leaves are simple, while those of the median portion, and sometimes those of the upper portion also are lobed, though frequently the uppermost zone of leaves is simple. It therefore appears reasonable to consider such simple leaves as may be found occupying the median portion of the branch as retarded forms. A splendid example of this kind of retardation is a sassafras tree growing in Bronx Park, New York City. It is between ten and fifteen feet high and for two seasons has been practically covered with simple leaves. Last season less than half a dozen lobed forms could be seen, while the season before none were found.



Here, then, is a case in which the retardation was throughout the entire tree and not confined to a few leaves. Similar trees, I believe have been seen elsewhere. The surrounding trees appeared to have the normal arrangement and number, of course in a general way, of lobed and non-lobed leaves.

The third case is similar to the preceding, in that all the leaves on the tree were affected. In this instance the tree was a young tulip tree, about fifteen feet high, growing on a rocky hillside in the upper part of the Hemlock Grove, Bronx Park, New York City. The leaves were larger than the average Liriodendron leaf, but were, without exception, much simpler in outline, possessing none of the characteristic lobing. These, too, though comparatively longer, reminded one of the cotyledons.

As to the cause of these retardations I can say nothing, though in the tulip-tree it may have been the poor soil, but this reason could not be urged for the other cases. Whatever the causes they probably affected the leaf in its embryonic condition.

New York City.

LOCAL NAMES OF FLOWERS.

BY MRS. FLORA SWETNAM.

SOMETIMES when one takes up the study of botany after arriving at a mature age, one is often surprised and delighted to find under a new name the old friends of childhood. The thing that confuses us and causes us to fail to recognize them when we read one of the common names in some story or magazine is, that many of them have several common names, a different one for each locality, and it is only when we run them to earth in a text book that we exclaim: "Why I know that! it's a very old friend; grandmother called it so and so."

I had never known arbutus by any other name than "rough-leaf" till I was quite grown up. Then a friend sent me a box of it under its proper name and my eyes were opened. But I found one great difference in that growing in New York State, and that found south of the Ohio. The arbutus growing south is not fragrant. Another common flower, called in different localities, dog-tooth violet, adder's tongue and lamb's tongue, I found to be often white north of the Ohio, while in Kentucky I have never found a white specimen. There was no difference in other respects.

I have never been able to find either skunk's cabbage or cat-tails in Kentucky, though it is possible I have not looked in the right places.

I had often read in stories about checkerberries, partridge-berries, boxberries and teaberries without having the slightest inkling that it was our old friend wintergreen often called "mountain tea" in the mountains of Kentucky. The wild geranium I only knew as "wild alum" so called, probably, on account of the astringency of its roots. And I had read so often when a little girl about the wind flower, and puzzled my brains till I found out later that I had gathered quantities of them as anemones.

The Prince's pine I should never have recognized to be another old friend, the pipsissewa, often called "rat's bane" among the Kentucky people. Neither could I recognize in the name jewel weed, the wild touch-me-not I had gathered in childhood. Another puzzle was toad flax. If any one had asked me if I knew that plant, I should unhesitatingly have replied no, until I found another of its common names was butter and eggs, and to hear that old time friend, milk weed, called silk grass was more bewildering still.

We have in the mountains of Kentucky, the spring beauty, the yellow and purple wood sorrel, wake-robin, buttercup, evening primrose, crowfoot and the blood root honored by some old people with a name I cannot spell. I think that magazine writer who was lamenting that our beautiful wild flowers are slowly disappearing, would find most of them represented in the hills of Kentucky.

West Liberty, Ky.

GROWTH OF EUCALYPTUS.—In the December number of *The American Botanist* there appeared an interesting note on the growth of trees in which was given the time required for various species to reach a diameter of twelve inches. I would like to add to this list, for comparison, *Eucalyptus globulus,* which has been so extensively planted in California during recent years as to entirely change the aspect of the country. Investigations carried on by the state forester show that under favorable conditions this tree will reach the diameter of one foot in 10 years, while it takes the catalpa 20, the walnut 56, and the white oak 100 years to reach this size. At this ago the eucalyptus will be about 125 feet high and growing at the rate of 15 feet yearly. In the height of the growing season seedlings have frequently been observed to make an average height growth of six inches a day. The most rapid seedling growth noted was made by a tree which in nine years reached a height of 125 feet and a diameter of 36 inches. The *E. globulus* is the most rapid growing among the eucalypts, and is without doubt the fastest growing hardwood tree in the world. For this reason it has been more widely planted in California than all other species combined, although at the present time large plantations of *E. rostrata* and *E. tereticornis* are being made as they furnish timber preferable to *globulus* for many purposes. Their rate of growth is also very rapid, under favorable circumstances being but slightly less than that of *globulus.*—*W. Scott Lewis, Los Angeles, Calif.*

NOTE AND COMMENT

WANTED.—Short notes of interest to the general botanist are always in demand for this department. Our readers are invited to make this the place of publication for their shorter botanical items. The magazine is issued as soon as possible after the 15th of February, May, August and November.

IMPATIENS PALLIDA ALBA.—I have neglected to report the finding of this variety in this section, but the item regarding it in the August *Botanist* brought it to mind. For several years I have been finding what I take to be the same variety of the yellow touch-me-not that was reported from Pennsylvania some five or six years ago, by C. H. Woodward. I have found it at two stations in this country, one in the northeast corner of this township, and the other near Chesterland Caves.—*Orange Cook, Chardon, Ohio.*

PHILIPPINE WOODS.—The newcomer in the Orient is usually surprised at finding that soft woods are not uncommon and that a large part of the timber of the region is of medium or light weight. The popular notion of eastern timbers seems to be that they are mainly hard and heavy, ornamental, furniture or cabinet woods. This notion is probably due to the fact that until recent years the only eastern woods which have reached the European markets have been a few of the more valuable ones for furniture and cabinet work; as ebony, rosewood, satinwood, etc. Most European and American works which mention eastern woods at all, consider only examples like satinwood, rosewood or teak and give little or no account of the wood of the great family Dipterocarpaceae which furnishes much the largest part of the timber of this part of the world. This is as unreasonable as it would be to take a few of the furniture woods of North America, as black walnut (*Juglans nigra*) or the wild black cherry (*Prunus serotinus*) as representatives of the woods of the country. In the eastern tropics the woods of the family Dipterocarpaceae are to the trade what the pines, spruces, firs, hemlocks, oaks and beeches are to the trade of temperate North America and Europe. This family, while it supplies many valuable hardwoods, supplies also the most widely used soft and medium grade woods of the eastern tropics. So wide is its distribution and so general the use of its wood that I believe that all the other woods could be spared from many eastern markets without seriously hampering work or affecting prices.—*Philippine Journal of Science.*

Rare Plants in Cities.—There seems to be a very prevailing idea that in order to find plants worthy of notice, one must go "to the heart of Nature" or to some other equally indefinite region. It has become customary to neglect the plants near at home as mere weeds and hence insignificant. As a matter of fact, these sturdy intruders, unwelcome though they may be, offer most interesting studies as to mode of life and as to dispersal of seed. We should not be so ready to sneer at the "weed"—it is a living example of the great law of survival, living on and accomplishing its continuance in an environment where other plants would have failed. From a "plants-eye view" it is a vigorous, virile and successful individual. The adaptations of root, stem or fruit that thus enable the plant to survive in face of most vigorous warfare are worthy of more detailed study than is usually given. From another point of view—it is surprising to note what plants may be found where we would least expect them. There is interesting field for "botanizing" even in the heart of Chicago. During a visit there last summer, I found on vacant land adjoining one of the great parks, *Cladium mariscoides, Carex Muhlenbergii, Potentilla argentea,* and numerous other species which one would hardly expect to find in the heart of a great city. Down nearer the business centre, on made ground along the lake front I found the rather rare *Heleochloa schoenoides* and *Roripa sylvestris.* On my return trip, having noticed *Dipsacus sylvestris* at Joliet I ventured to trespass on friend Clute's botanical hunting ground for some specimens of "teasel"—a weed truly but one I have seen only at Joliet and in central Indiana. Among the rank spiny plants I found also *Conringia orientalis.* In a neglected back yard nearer home, I found *Verbascum phlomoides* and *Polygonum cuspidatum* in most vigorous luxuriance, while along the sidings of railway switchyards in the same city were found *Alyssum alyssoides* and, as a chance visitor—but making the most of its new surroundings.—*Amsinckia spectabilis.—M. P. Somes, Iowa City, Iowa.*

The Year's Plant Products.—From the soil and the air, during the last season, the plants cultivated by man in the United States have built up products valued at the vast sum of nearly nine thousand million dollars. Corn comes first with a value of seventeen hundred million dollars, king cotton follows with eight hundred and fifty millions, wheat seven hundred and twenty-five millions, hay six hundred and seventy-five millions, oats four hundred millions and potatoes half as much as oats. Reducing the increase to daily amounts it is seen that every day of the 120 days during which the corn crop was growing, this single crop added about fifteen millions of dollars to our capital. And all this vast gain of all the crops, began as carbon dioxide and water in the cells of the plant,—cells so small as to be invisible to the naked eye.

Trifolium Procumbens.—For three years I have found the low hop clover upon cur lawn and at one other point in this village. Until three years ago I had never seen the plant though I have been studying the flora of this section for over thirty years.—*Orange Cook, Chardon, Ohio.*

Postage on Specimens.—It may not be generally known (but to the impecunious naturalist, at least, it is worth knowing), that the Express Companies carry your specimens for half a cent per ounce, as against the one cent charged by U. S. Post. This, whether the destination is Mexico, or Canada, or your next-door town. This route is not only safer and more expeditious, but also allows for any amount of written matter, which, under a strict construction of the postal laws, is forbidden. If any controversy arises with your agent, refer him to "Section D."—*Rev. J. Davis, Hannibal, Mo.*

Jingoism and the Price of Cabbage.—In these "piping times of peace" our martial legislators—who expect to remain at home in the event of any unpleasantness—are as busily preparing for war as ever. During the ten years ending with 1906 our government spent twenty hundred millions of dollars for war and in the same time spent much less than half of one hundred million for the development of agriculture and then we are some of us silly enough to wonder at the high cost of living. If things continue in this way much longer we shall have to stop hunting for trouble with foreign nations long enough to hunt something to eat for ourselves. The farmer does not need a contribution in cash, being pretty well fixed as it is, but he does need better roads and until he gets them the cost of bringing his products to market will continue to be added to the cost of living. It has been shown by careful investigations, that with improved roads more than 150 million dollars could be saved each year in the cost of marketing the crops. In ten years we have spent 180 millions in improving rivers and harbors but not a cent for good roads. Progressive commonwealths have done something for their own roads so that about two per cent of our roads are improved, but we would like to see one or two battle ships traded off for road making machinery.

Color of Turtle-head Flowers.—In an article in the *American Botanist* for August, a writer from Wisconsin says the flowers of *Chelone glabra* are "decidedly cream colored." Near my home, in the hills of Central Pennsylvania, these flowers are always pink, being a deeper shade at the tip of the corolla.—*Nell McMurray, New Washington, Pa.*—[The editor can add that while he does not recall any really pink flowers, he has found possibly a majority of the flowers in Southern New York to have the corolla tipped with pink. Doubtelss the locality and perhaps the season may have something to do with it. In this connection it is of interest to note that *Chelone Lyoni* a plant well known to dealers in wild flowers, has deep pink corollas and is frequently planted for ornament.—*Ed.*]

Fruiting of the Peanut.—Although the peanut is a common and well-known plant, considerable mystery surrounds its manner of fruiting, in the popular mind. The blossoms are borne as any ordinary flowers are, but the fruits are found under ground and many imagine that they are similar to potatoes in the way they are formed. Various other curious views as to their formation are held and there are not a few people who think that after flowering, in order to have peanuts, the blossoms must be picked off and buried about the roots of the plant. Others have an idea that peanuts come from cleistogamous flowers similar to those which produce fertile violet pods. The real facts are these: The peanut flowers in the regular way and is either self-pollinated or pollinated by insects. After the flower-parts have fallen the flower stalk lengthens, turns downward and forces the beginning fruit into the earth where it ripens. It is easy to make the experiment with the plant for ones self. Unroasted peanuts may be obtained at the nearest peanut stand. Almost any garden soil will do though a sandy loam is best.

Trees of America and Japan.—We look in vain through the forests of Europe for such familiar forms as the hemlock, the hickories, the tulip tree, the magnolias, the sassafras, the tupelo gums, the witch hazel, the Kentucky coffee tree, the yellow wood, the locusts, the catalpa and the liquidambar. Strange as it may appear, nearly al of these eastern American forms occur nowhere else in the world save in eastern Asia, in the more temperate parts of China and Japan where the same or very nearly related species are found. What is even still more striking is the contrast between the Atlantic and Pacific sides of North America. Excepting along the mountain crests where the more or less world-wide boreal plants find a congenial environment the vegetation of the California region is related mainly to the dry plateau lands of Mexico and South America. So far as the trees are concerned, a native of the eastern United States would find himself in more homelike surroundings in the woodlands of temperate China and Japan than on the Pacific slope of his own country. A tulip tree very similar to the one at home, almost, if not the identical species of sassafras, numeous closely related magnolias, a near relative of the southern yellow wood, the liquidambar, the catalpa the coffee tree the hemlock and other forms appear as familiar trees in the landscape of China and Japan. This likeness between the two widely separated regions is not confined to the trees alone. The flora at large presents many features in common. The fox grape, the poison ivy, the hydrangeas the wistaria the blue cohosh the may-apple, the twin-leaf, the trailing arbutus or mayflower, and the creeping snowberry have each a more or less closely related form in eastern North America and Eastern Asia but are found in no other part of the world.—*Popular Science Monthly.*

Ancient Plant Lore.—The Assyrian King, Sardanapalus, must have been quite a book-worm if we may judge from his library. Some twenty thousand stone tablets from it have been dug up in the ruins of Nineveh. Those informed in matters of cuneiform script report that the library is rich in lists of plants and directions for their use in medicine and the like. Indications seem to point to the fact that the old Babylonians knew more about plants than their successors the Greeks and Romans. We hope this is a mistake; otherwise the "priority" people will begin to introduce these older names which have been literally dug up. Who knows but what we may ultimately be expected to describe our plants in cuneiform characters instead of the latin now so much in fashion!

Ups and Downs of the Name Tinker.—Evidently the nomenclature game is one that several can play at and the fact that nobody knows who has won until the last hand is played adds to the excitement if not to the good feeling of the players. A few years ago, one of our eminent botanists thought a certain ancient volume gave him the right to throw out *Negundo* as the generic name of the box elder and to replace it by the outlandish word *Rulac.* Recently the scholarly editor of the *Midland Naturalist* has shown that *Negundo* really has priority under the rules and away goes *Rulac* and back comes *Negundo.* This is all very well, except that in the shuffle the *Rulac* man lost out of the combination and a new name takes his place. He will rulac no longer though he may rue *Negundo.* Another old name caught the editors of the new "Gray's Manual" napping. In this edition a common wayside weed known as velvet-leaf or butter-print is named *Abutilon Theophrasti* this name displacing the better known *Abutilon avicennae.* The joker, in this case was that the name *avicennae* attributed to Gaertner, while antedated by the name *Theophrasti,* was also used for the plant by a still earlier writer and so *Theophrasti,* goes on the scrap heap along with other blasted hopes.

THE WONDER-BERRY POISONOUS.—According to Burbank, the wonder-berry is a hybrid between an African species of nightshade called stubble-berry (*Solanum Guinense*) and the Pacific coast rabbit-weed (*Solanum villosum*); according to various botanists it is simply an improved variety of the west coast plant, *Solanum villosum.* The wonder-berry is described as being much like the common blue-berry in taste and quite devoid of the poisonous principle that make other species of nightshade inedible, but there are some that report it to be poisonous. Allowing the plant to be a real hybrid as claimed by the originator it is possible that both parties to the controversy are entitled to some credit. If it follows the law of hybrids in general about one quarter of the seeds would be expected to produce the characters of one parent, one quarter the other parent and the rest hybrids as before. Burbank claims that the two original species are so blended in the hybrid form that the latter becomes a distinct species but even if the form gives no hint of the parent species, who shall say that the physical natures of the two do not breed true to Mendel's law. This would account for the fact that such excellent botanists as W. Watson of Kew pronounces the fruit poisonous. He may have examined plants that had the rabbit-weed constitution. At any rate. he reports the poison solanine, present. On the other hand those who contend that the fruits are innoxious may have had the other variation in hand.

Pine Seeds as Food.—To many people in the United States the seeds of the pine seem to have little economic value. Seeds of the eastern and southern pines are two small to be of any value but in the southwest are several species with seeds large enough to form an appreciable source of food. In some sections pine seeds may be regarded about as beechnuts are in the New England and Middle States, but in others they are held in considerable esteem. Gathering pine seeds is a recognized industry among certain Indian tribes. In South America the Chilian pine or monkey-puzzle tree (*Auraucaria*) a plant well known in cultivation in greenhouses on this side of the equator, yields a large amount of food. One tree, it is reported, will supply food for a dozen persons. The cones are six inches or more in diameter and each scale encloses two seeds an inch or more long. Since the cones are borne in abundance the pine seed harvest is of much value.

Growth Rings.—In regard to the growth rings you mention on page 88 of the last volume I have heard what I think to be a satisfactory explanation, though to what extent proved by experiment I do not know. I refer to the "fairy circles" of basidiomycetes and the explanation applies to the plants in question as much, I think. It will be noticed that the circles are larger every succeeding year and it has been said that the plants use up the humus food proper for them and naturally extending outward as the spores are annually dispersed. Starting from a small patch they pass outward every season because the food supply gives out where they were the preceding year. Of course the spores are spread over the whole lawn but the greatest abundance is found where the plants are and the adaptation to environment best, hence the reason for the gradually increasing circles. The effect is certainly strikingly beautiful. The circles stand out clearly in a well-cropped lawn some four days after a rain. —*J. A. Nieuwland.*

Speed of Diatoms.—Nearly everyone who has peeped through a microscope has seen one or more species of diatoms. The cell-walls of glass most beautifully and delicately marked make them prime favorites with the microscopist, indeed one species of diatom is said to be used in testing lenses. Notwithstanding their glassy cell-walls, diatoms are really plants, though to see them moving about on the slide of a microscope the hasty observer might jump to the conclusion that they are animals. The movements of these plants have often provoked speculation. Though seemingly rather lively it must be remembered that the microscope magnifies the motion as well as the plant. The progress of the diatom is therefore said to be relatively slow. Just how slow it is has been figured out by T. Chalkley Palmer in the "Proceedings of the Delaware County Institute of Science." Comparing the diatom, with a man, he finds that to equal the diatom man would have to go at the rate of more than 23 miles an hour and drag with him 2520 pounds of extra weight; or if he should devote the energy necessary to move this weight to locomotion alone, he would have to strike a gait of more than 450 miles an hour. Evidently the diatom is not so slow after all.

SCHOOL BOTANY

STUDYING BUDS.

What do we expect to accomplish by the dissection of buds in the high school course in botany? Are we after fundamentals or are we simply "studying buds?" A good many teachers seem content to assure the pupils that there are three types of buds: the leaf buds, the flowers buds and mixed buds containing both flowers and leaves; but a good teacher will not stop here. The average pupils has an idea that all buds contain flowers and it may require some little effort to convince him that the leaf bud is far more abundant than any of the others and that even this does not produce leaves, merely, but a young twig as well.

Then there are growing buds and resting buds, the later often with scarcely more protection than the growing buds though usually such buds are well protected by bud scales. If we are after the fundamentals we shall have to show that the bud scales are really transformed leaves or parts of leaves, decide what becomes of them when the buds begin to grow and examine various methods which plants have evolved for protecting these growing points through the winter.

A lilac bud is one of the best for showing that the bud scales are transformed leaves. The transition from the scaly parts without to what are clearly leaflike parts within is so gradual that the most stupid pupil can see and understand. In a second type of bud the scales have gone too far on their way to ever be able to function as leaves and when spring comes they fall off leaving a circular scar around the twig. This scar is not noticeable in plants like the lilac in which even the bud scales become leaflike. As an illustration of the second type of bud the horsechestnut is usually suggested, but in many localities a better one may be found in the buckeye. The glue-like covering of the horsechestnut's bud scales is of interest as illustrating an additional device for protecting from evaporation, but this same sticky substance prevents a proper dissection of the bud by beginners. In addition, the young leaves in the bud are so heavily coated with hairs that it is difficult to make out their parts. This cannot be said of the buckeye. The leaves are downy it is true but not enough so to obscure the parts and the bud-scales are quite devoid of the varnish.

Among the curious methods of bud protection, nearly every text cites that of the sycamore or buttonwood in which the bud is said to be protected by the petiole of the leaf. This, however, cannot be said to be a protection to the bud in winter inasmuch as the leaf falls in autumn. It simply protects the young bud until maturity. There are other plants, however, easily obtainable in which the petiole really protects the bud through the winter. The common red raspberry, the flowering raspberry and the cat brier or smilax may be mentioned as good types of this. In these, instead of the leaf being cut off at the base, a cleavage plane develops at some distance above the bud and when the rest of the leaf falls the petiole stub remains subtending the bud.

It is not easy for the teacher to find suitable material to illustrate the arrangement of accessory buds. The red maple is often suggested for the type having the accessory buds beside the lateral or axiliary buds but this tree is not always to be found nor does it illustrate the phenomenon any too well. The peach, the forsythia and some oaks are usually as easy to obtain and show the arrangement even better than does the maple. For that form of bud arrangement in which the accessory buds are arranged above the lateral buds, the pipe-vine and *Pterocarya* are often suggested. A good many teachers are not familiar with these, but just as good material for this work may be obtained from vigorous young twigs of ash, walnut, or butternut, the latter by preference.

Witch hazel is a fine type of naked bud when it can be obtained, but if it is not at hand, the pawpaw, butternut and many of the viburnums especially the cultivated ones, will do. In this connection it should not be forgotten that there are many buds not protected by bud scales which are not usually named as naked buds but which are essentially such. Buds like those of the catalpa, sumac and ailanthus are, at the beginning of winter, scarcely more than mere living points, half buried in the bark of the twigs but later in the season they will show their character. For class work these should not be used if better things can be obtained.

Probably the most important facts about buds from the pupil's standpoint are the ways in which they are arranged on the twigs, what they produce and how and from what they are protected. It is well to emphasize the fact that buds do not protect from cold for the moisture in them is often frozen solid during the winter. Yet nine persons out of ten one meets is sure that the chief use of bud scales is to protect from the cold. In this they draw an analogy from their own clothing, forgetting that the warmth is supplied to our clothing by the heat of the body. That bud scales may protect from sudden changes of temperature, no one can deny, that their color may aid in warming up in spring is possible, but the real uses of bud scales seem to be to protect from complete evaporation, mechanical injury and decay.—*C. N. W. in School Science and Mathematics*.

USE OF THE WORD MONOCOT.—The words *monocot* and *dicot*, used to indicate plants produced by seeds with one and two cotyledons respectively have at present, no standing as legitimate words but there seems to be no reason why they should not have. The dictionary allows us monocotyledon and monocotyl but frowns upon any further shortening of the words as the writer found to his discomfiture, recently in trying to get these words past an argus-eyed proof-reader with a limited knowledge of botany. For some reason the word, monocotyl has never struck the fancy of botanists, but in practically all the laboratories and even in addresses we hear the shorter, though discredited terms used. When we come to written work however, we nearly always find everything relating to the two great groups of angiosperms mentioned as monocotyledonous and dicotyledonous.

It may be permissable to call a plant with one seed leaf a monocotyledon, but it is rather a confusion of terms to write, as we constantly do, monocotyledonous stems and monocotyledonous leaves. Does not the word monocot stem express the same idea with less confusion? We certainly think so and see no reason why teachers should have any hesitancy in using the term both in speaking and writing. Here and there a courageous author—one who is strong enough to dictate to his publishers—has used the word in print and we find such usage by no means confined to those too ignorant to know better. Ruskin uses the word and among more modern instances we may cite the recently published "Nature Study" by Coulter and Patterson.

MONOCOTS AND DICOTS.—Ask the average student to give the differences between monocots and dicots and he is likely to answer that monocots have seeds with one cotyledon, stems with scattered bundles, leaves with parallel veins and flowers whose parts are usually in threes, while dicots have two cotyledons, stems with bundles in circles, leaves with netted venation and flowers with parts in fours or fives. This will do for a general distinction though there are numerous plants that disregard these boundaries. There are several dicots whose seeds and stem structure resemble those of monocots, the leaves of flax, a dicot, are parallel veined, while the monocot arums, yams and trilliums have netted-veined leaves. Several monocot flowers are four-parted notably *Aspidistra* and *Paris*. Dicots with three or six parted flowers are not rare. There are numerous lesser differences between the monocots and dicots, however, none of which will hold for all the species in the group, but are nevertheless characteristic enough to be noticed. In the monocot the bundle is "closed" and lacks combium, in the dicot it is "open" and has cambium; in the one the leaf-edge is entire in the other notched; the root-system lacks a tap root in the first, and usually possesses it in the second. Monocots more frequently lack a petiole and the leaves are not cut off by cleavage planes, dicot leaves are just the reverse. The seeds in monocots usually have endosperm, and the cotyledon is terminal, in the dicots the seeds usually lack endosperm and the cotyledons are lateral. Monocots usually store food in the stem or leaves, dicots in the root. Monocots seldom branch, dicots usually do. Monocots inhabit warm and dry regions, dicots can stand more cold.

Teaching Agriculture.—The subject of agriculture should be incorporated into the science work of the high school and not superimposed upon the already crowded high school course—a mistake that has been made often enough that it should begin to be apparent to the friends of agricultural education. And for this purpose, only the "principles" of agriculture (or any other vocation) have a right to a place in the course. That all principles of agriculture are scientific principles and as such are the most familiar and available for cultural use is here asserted. Courses of study providing specific methods and practices in the economics of cutivation of particular crops, harvesting, preservation, breed peculiarities, care of herds—all being matters of information and skill in the vocation of agriculture, have no more place in a general high school course than have the methods and technical phases of commerce, telegraphy, music, photography, pharmacy, assaying or a multitude of other subjects which the high school course deals with theoretically without aiming to turn out skilled operatives. The advocates of agriculture education in the high school should be satisfied to have accurate instruction given in the general principles including sufficient illustrative practice of the vocation to enable the pupil to master the details in his own peculiar way.—*Josiah Main, University of Tennessee.*

KEY TO THE FAMILIES OF THE MONOCOTYLEDONES.

The beginner frequently has considerable difficulty in naming his plants by the use of modern keys,, because of the strictly scientific character of the latter. It is the aim of the maker of a key, to put into such descriptive terms as shall make the identification of a plant certain from the key alone, and while this is a prime requisite from the point of view of the scientist, a more general key which shall gradually sift out his plants is likely to be more useful to the botanizer who recognizes his favorites quite as much by their color and habitat as by more scientific characters. We have therefore prepared a key to the monocots based upon the more obvious characters of the plants, and one which makes even a simple lens superfluous. If this meets with the favor of our readers, we hope to issue keys for other divisions of plants. The key is strictly dichotomous or forked. Of each two lines, one is the opposite of the other. Lines which do not end with a family end with a number which refers to two other lines farther down the page. The letters and figures in parenthesis after each family indicate the pages upon which the families will be found in the latest editions of Gray's Manual and Britton's Flora.

ts very small without true leaves. Aquatic.	Lemnaceae. (G. 259. B. 232)
ts larger, leafy (2)	
lowers in a dense head or on a spadix (3).	
Perianth colored, conspicuous.	
Flowers yellow.	Xyridaceae. (G. 262. B. 235)
Flowers white.	Eriocaulonaceae. (G. 261. B. 236)
Perianth inconspicuous or wanting.	
Spadix on a scape or in a spathe.	Araceae. (G. 257. B. 229)
Spadix spike-like.	
Submersed or floating plants.	Naiadaceae. (G. 69. B. 40)
Marsh plants, erect.	
Flower clusters cylindrical.	Typhaceae. (G. 67. B. 38)
Flower clusters globular.	Sparganiaceae. (G. 67. B. 39)
owers not in dense heads nor on a spadix (4).	
4 Flowers surrounded by husk-like scales.	
Stems solid, sheaths entire.	Cyperaceae. (G. 171. B. 158)
Stems usually hollow, sheaths split.	Gramineae. (G. 86. B. 61)
4 Flowers with conspicuous perianth (5).	
5 Ovary inferior, perianth adherent (6).	
6 Stamens one or two; flower irregular.	
Anthers one-celled. Seeds solitary.	Marantaceae. (G. 304. B. 288)
Anthers two-celled. Seeds many.	Orchidaceae. (G. 304. B. 289)
6 Stamens three or more; flowers mostly regular.	
Leaves net-veined; plants climbing.	Dioscoreaceae. (G. 297. B. 281)
Leaves parallel veined; not climbing.	
Perianth woolly on the outside.	Haemodoraceae. (G. 296. B. 278)
Perianth not woolly.	
Flowers dioecious or polygamous.	Hydrocharitaceae. (G. 85. B. 59)
Flowers perfect; terrestrial.	
Stamens six.	Amaryllidaceae. (G. 297. B. 278)
Stamens three.	
Alternate with the inner segments.	Iridaceae. (G. 299. B. 281)
Opposite the inner segments.	Burmanniaceae. (G. 304. B. 289)
5 Ovary superior; perianth free (7).	
7 Calyx and corolla unlike in color.	
Carpels several, distinct.	Alismaceae. (G. 80. B. 53)
Carpels three united.	
Leaves three or more, in whorls.	Trilliaceae. (G. 279. B. 273)
Leaves alternate.	
Stigmas three. Epiphytes.	Bromeliaceae. (G. 265. B. 238)
Stigmas united into one.	Commelinaceae. (G. 264. B. 239)
7 Calyx and corolla colored alike (8).	
8 Leaves net-veined.	
Flowers dioecious, six-parted.	Smilaceae. (G. 279. B. 275)
Flowers perfect, six-parted.	Trilliaceae. (G. 279. B. 274)
8 Leaves parallel veined (9).	
9 Styles and often the stigmas united.	
Flowers greenish.	Juncaceae (G. 267. B. 244)
Flowers colored.	
Regular; stamens six.	Liliaceae. (G. 279. B. 260)
Irregular or with three stamens.	Pontederiaceae. (G. 266. B. 242)
9 Styles and stigmas three, distinct.	
Ovary three-seeded.	Juncaginaceae. (G. 79. B. 52)
Ovary six or more seeded.	Melanthaceae. (G. 279. B. 254)

EDITORIAL

With this number we begin a department devoted to school botany which, though intended primarily for teachers, we hope will be of value to all students of plants. The ordinary botanist—by which we mean the person interested principally in collecting and exchanging—rarely realizes how much he is affected by the botany taught in schools. We are all desirous of seeing the tribe of botanists increase, if only for the satisfaction to be derived from the knowledge that our favorite study is a popular one, and we must therefore be concerned with the subject matter and extent of the botany courses in the schools. Not until recently has botany been taught by the laboratory method, unless we dignify by that name the pulling to pieces of a few flowers in the class-room, and in possibly a majority of schools in America botany is still taught "out of a book." Good botanical teaching by the laboratory method is not without its difficulties and it is our aim to remove as many obstacles of this kind as possible from the path of the young teacher. To this end we solicit the notes, queries and suggestions of the large number of teachers among our readers.

* * *

During the past few months we have been hearing a great deal about a deficit in the postal service of the government, and the effort that is being made to remedy matters in future. The proposal to make up the loss in other departments by raising the mailing rate on magazines has met with very decided objections, not only by the magazines concerned but by the reading public as well. As is well known, magazines regularly published go through the mails at the rate of one cent a pound, but over in Canada the same magazines are carried at the rate of a quarter of a cent a pound and there is no deficit either. The deficit in our own service is due to many causes among the foremost of which are the cost of the rural free delivery, and the expence of carrying an immense amount of matter for the government free. But deficit, or not, one thing is certain. If the rates are raised on magazines every reader will have to pay more for them. If you think you are paying enough as it is, you should call the attention of your representatives in house and senate to the fact.

* * *

During the past nine years, no less than twenty seven thousand, eight hundred and thirty-one periodicals in this country have suspended publication, and there are only about six thousand left. Those who are of the opinion that magazine publishers constitute a majority of the millionaire class may ponder these facts with good results. If the life of the publisher was bound up in his magazine, as his interests are, magazine publishing would be placed by life insurance companies among the extra hazardous occupations along with handling dynamite and flying air-ships. Anybody who would like to try publishing, however, will find that there is nothing especially difficult about it. A magazine is a good deal like an air-ship. All you have to do is to make it go and keep it up and beware of too much wind.

* * *

Probably most of our readers are familiar with the name, at least, of the Open Court Publishing Company, of Chicago. The company was formed some fifteen years ago for the purpose of publishing books on Philosophy, Science and Religion. The nature of the works published do not ensure for them a very extensive sale, but this does not worry the company for it has an endowment fund of *one million dollars!* In considering the publication of a book, then, this company need not be influenced entirely by the likelihood of its becoming one of the "six best sellers." If it merits publication it is published, and if the public does not know enough to appreciate it, so much the worse for the public. It is to be regretted that somebody with means does not see the opportunity to do something handsome for the world by capitalizing the scientific press in much the same way. In fact we feel sure that the time will come when this will be done. The bequests of wealthy Americans for schools, hospitals, churches and libraries run into the tens of millions annually, and while small amounts may be given to endow various phases of research work in science in the colleges and Universities, not a cent goes toward the work of making science understandable to the common people, though our commercial greatness as a nation depends largely upon agriculture and that in turn upon botany and zoology. The spread of a knowledge of plants and animals is handicapped by a lack of adequate means for its dissemination. The botanical magazines especially are failures financially. The editors serve without pay and the contributors write with no thought of remuneration. Good work of any kind is seldom done with the thought of reward in mind—a piece of work well done is reward enough to one in love with his work—but the fact remains that the knowledge of plants is likely to spread slowly if left to the efforts of underpaid botanists. We need an endowed magazine or publishing company that shall issue meritorious works on botany whether the public is yet ready for them or not. A properly endowed magazine could make plant study so attractive that practically every child would become an enthusiastic plant student.

* * *

The Chicago Academy of Sciences has recently issued a bulletin on the Higher Fungi of the Chicago Region by Dr. W. S. Moffatt. This forms part of the natural history survey of the region by the Academy. It contains keys to the species and genera of Hymenomycetes found in the region with descriptions of the species and 24 excellent plates from photographs.

BOOKS AND WRITERS.

The tribe of Burroughs and Thoreau, of Bradford Torrey and Wilson Flagg has gained a new recruit in the person of Winthrop Packard whose two graceful volumes "Woodland Ways" and "Wild Pastures," recently issued by Small Maynard & Co., add a new note to the literature of out-door life which has been growing a trifle catalogue-like of late. One finds in these books no directions for knowing either beast, bug or blossom and yet they deal with all three from the viewpoint of one who loves undissected nature and is alive to its varied phrases. Both books have been inspired by the wild nature in the vicinity of Boston—sights, sounds, and happenings in the bird and insect world, that have doubtless been seen, time and again, by other observers, but never before recorded by one with a talent for seeing the unusual in the commonplace. The strict scientist may find the books a bit too fanciful, the language a trifle too flowery, and he may complain that nothing especially new is given to the world in their pages, but to one who loves nature for its own sake, such chapters as "Brook Magic," "Waylaying the Dawn," "The Frog Rendezvous," "The Pond at Low Tide," "Thin Ice" and "White-faced Hornets," will recall many pleasant days spent afield and prove most enjoyable reading. The price of each book is $1.25.

Nearly everybody who knows birds is also familiar with the various helps to their identification issued by Chas. K. Reed, Worcester, Mass. For several seasons the "Bird-Guide" in two tiny volumes devoted to the land and water birds respectively, has been a prime favorite with many students and there has recently come to join the group a "Flower Guide" built on the same general lines. The latter has as a sub title "Wild-flowers east of the Rockies" but in a book of its size, only the more showy species, of course, could be outlined. There are upwards of 200 flowers illustrated, however. The reviewer feels bound to say that while the convenient size of the guide will make it useful in the field, it lacks much of the artistic finish of the bird guide and the poorly colored drawings and rather inaccurate outlines detract in great measure from its usefulness to the beginning student. On the other hand, the habit of the more showy flowers make their identification comparatively easy. In any event, the booklet will do its share toward popularizing flower study. The price of any of the guides is 50 cents.

The Universal Scientific Alliance of Mexico has began the publication of a monthly magazine of Natural history entitled "Boletin del Comite Regional del Estado de Durango." The first number is dated December 1st, 1909 and is edited by Prof. Isaac Ochoterena. It contains several articles on the botany of the State of Durango as well as other matter. There seems to be a wide field for such a magazine in Mexico, and those in the United States who read Spanish will be interested in it. It is published at Durango, Mexico.

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FLOWERING RASPBERRY.—*Rubus odoratus.*

THE AMERICAN BOTANIST

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'Tis like the birthday of the world
When Earth was born in bloom;
The light is made of many dyes,
The air is all perfume.
There's crimson hues, and white and blue;
The very rainbow showers
Have turned to blossoms where they fell
And sown the Earth with flowers.
— **Hood.**

THE PLANTS OF THE SAND BARRENS.

By Willard N. Clute.

OF the three groups into which the botanist divides the plant world on a basis of habitat, the mesophytes are by far the most abundant and least attractive. As the name indicates they are the middle plants—those exposed to no extremes of moisture or dryness—and, like people whose existence moves along in well ordered ways, the story of their lives is likely to be humdrum. If we read biography we wish an account of stirring adventures, successful campaigns and difficult tasks accomplished. It is much the same with plants. There are many species among the mesophytes, the plants of our meadows, stream-banks and woods, well-worthy of notice but for real interest we must turn to the hydrophytes of xerophytes. Here we have plants of extremes and like all other living things, when in extremity they are likely to do the extraordinary. The hydrophytes are water plants and the variations they show us are mainly due to their attempts to cope with too much moisture. It is usually easier, however, to get along with too much of a good thing than not enough, and we find this exemplified in the xerophytes or drouth plants which for ages have been taught in the hard school of experience to husband by all the means in their power the small amount of water which they may suck up in their arid habitats. Among them we find the most attractive and interesting of plant forms.

In many regions, one may find representatives of all three groups. If any are lacking it is likely to be the xerophytes for these are true desert plants. It is not necessary, however, to have a desert, in order to find examples. A ledge of dry exposed rocks will furnish conditions quite comparable to those of the desert and prove inhospitable enough to the few mosses, lichens and annuals that may endeaveor to maintain life upon them. A region of sand dunes, is also one of the best in which to study the xerophytes. A number of the typically desert plants are, of course, lacking, but the remainder are still so characteristically drouth-plants that it is not difficult to look at them and imagine a real desert. The sand dune region is interesting, too from another cause. Usually between the hills of sand are held small depressions containing water in which a typically hydrophytic flora abounds, and we thus have the two extremes of vegetation side by side with few if any of the intermediate plants.

An interesting feature of a sand-barren floras is the distinction that the soil makes between the so-called "calciphiles" or lime-loving plants and the "calcifuges" or those that do not grow well in calcareous soils. It is a difficult matter to find representatives of the great heath family in lime-stone regions, and a still more difficult matter to make imported heathworts thrive in such soils. It is from this cause that one cannot have thrifty rhodendrons in some localities. The absence of sphagnum bogs and their replacement by sloughs and swamps is also influenced by calcarous matter in soil water. But in sandy and clayey regions the heaths abound; in fact this has been so thoroughly impressed upon even the popular mind that dry and sterile regions are usually called heaths. Typical heath plants in the Northern States are the kalmias, wintergreens, huckleberries, blue-berries, deer berries, andromedas, arbutus and bear-berry. In the bogs of such regions we find another set of heaths that may still be said to be drouth plants though their roots are immersed in water. This is due to the fact they find it difficult to absorb moisture from the bog water. Thus while their relatives on the sand hills are in a physically dry soil they are little better off for their habitat is physiologically dry. Some of these are the leather-leaf, marsh rosemary, cranberry, snow-berry, and some of the huckleberries and laurels. It is not unusual to find considerable stretches of both sand and bog in which few things grow except heathworts.

Another distinction made by the soil is due to the absence of certain minerals necessary to plants. Sandy regions are usually lacking in nitrogen compounds and only such plants can thrive in them as have special means of obtaining the essential nitrogen. In the moist places we find the pitcher-plants, sundews, butter-worts and bladder-worts setting their seductive traps for insects, and on the sand hills are a multitude of legumes which have gone into partnership with bacteria that are able to obtain nitrogen from the air. These latter are among the handsomest plants of the sand-barrens and include the lupines, baptisias, tephrosias, partridge-peas, vetches, and the like.

Sand-barren plants, like xerophytes in general, have numerous ways of retaining moisture, once it is in the plant. The majority spread the minimum leaf surface to the air, and the cactus goes altogether without leaves, such starch as it needs being made by its thick stems. A great number of plants are covered with hairs which very effectually retard evaporation, and such plants as lack a hairy covering will be found to have placed their dependence upon a thick epidermis or a dense coating of wax or "bloom." Turning to the water plants we find a complete absense of these protective devices, an additional proof of the soundness of our theory.

The roots of our sand plants extend for long distances under ground, often going straight down for many feet. It is one thing to admire the handsome plants of the barrens, and quite another to dig them up for transplanting. A few trials even in soft sand will convince the botanizer eager to cultivate these plants, that it is far better to try to secure plants from seeds than to dig them up. It is likely that even a sand barren is never as dry as it looks. Not so very far beneath the surface there is a moist layer, and this is slow to evaporate becaue the soft sand at the surface acts as a mulch and breaks the chain of capillary moisture that would otherwise rise. Some of these sand-plants, then, are not so much plants that can live without water, as they are plants that have learned to go deep for their supply. Shallow-rooted plants cannot hope to compete with them.

Not the least of the charms of sand plants com
blossoms. Plants with insignficant flowers are the exception. Whether it is due to the habitat. or to the necessity of bidding high for the visits of insects, certain it is that showy flowers most abound where conditions are most unfavorable—on mountain tops, in the desert. in arctic regions and the like. As with men, it seems to require a certain amount of trial to develop their best points. Added to this the generally lessened leaf surface and the under populated soil, makes each blooming plant stands out like a bouquet. One has but to call to mind that magnificent plant the butterfly-weed, or the bracted baptisia, or the lupine or bird-foot violet to understand what is meant. The barrens are probably always more floriferous

than other regions when once they begin. The desert not only blossoms like the rose but beats the rose to it. It may be with a square mile of violets, an endless cloud of lupines, the yellow suns of the rock-rose, and *Agoseris* or long banks of hudsonia or the golden aster, but in any event the result is to outshine other regions.

Next to the sand-barrens in the matter of flowers come the prairies. At certain seasons they crowd the barrens close for supremacy. It is not given to every botanizer to have easy access to both regions but some are so fortunate. A very few miles from where this is written, an arm of the true prairie extends eastward over the Niagara limestone until it encounters the sand dunes at the southern end of lake Michigan, bringing hydrophytes, mesophytes and xerophytes into close juxtaposition. Here in certain directions the flora changes more in going five miles than it would in going five hundred miles in other regions. Since both prairie and barren are of low altitude many of the flowers of mountain and ravine are absent, but they can well be spared in view of the other attractions which the region affords.

Joliet, Ill.

THE FLOWERING RASPBERRY.

By Dr. W. W. Bailey.

IT is the experience of every wood-lover that the thought of certain plants is potent to recall special localities upon which the mind loves to dwell. In turning over the sheets of his herbarium, the attention of the botanist is always arrested by the portrait of some favorite plant, "the shy Linnaea" perhaps, or the alpine sandwort, and at once he is borne into dreamland as by the magician's carpet. Home objects vanish; he is once more in deep odorous woods or well above the clouds upon a New England mountain top.

One of the plants all powerful to summon up half sleeping memories of loved spots and dear companions, is the flowering raspberry (*Rubus odoratus*). Growing as it does on our lower mountains, like Wachusett or Monadnock, the Catskills and Hudson highlands, or around the bases of some of the higher ones like the White Mountains, it is naturally associated with scenes of uncommon beauty. To the writer it recalls his childhood home, West Point and fond recollections of those long departed. When one lands at Highland Falls about a mile from West Point, his attention is arrested by a stupendous cliff upon the summit of which is perched Lady Cliff Academy—a Catholic girls' school. The road up to the village is embowered in beautiful shrubs and trees and herbage. There grow magnificent tulip trees and native lindens, birches, maples and other deciduous trees. There too, one sees the bladder pod, with very pretty flowers in spring, followed later by the inflated pods that children love to pop. Lower than these, appearing as bushes three to five feet in height, are the flowering raspberries with ample, maple-like leaves and corymbs of rose-purple flowers—resembling, and almost as large as, wild roses. The stems and petioles are clothed with interlaced rufous hairs and the flowers are succeeded by large, red, attractive-looking, but poor, insipid-tasting, berries. The plant seems to satisfy itself when it produces such showy flowers. The black raspberry or thimble-berry shows the opposite condition. One can scarcely find the flowers but the fruits are large and luscious.

In the far West grows another species strikingly like *Rubus odoratus* but with white flowers. It is *R. Nuttallii.* The thought of it always brings back to me my first day's botanizing on the Sierra Nevada. It was when I was with the U. S. Geological Exploration of the 40th Parallel under Clarence King. We went into camp at Alta on the western slope and near the highway over the mountains. Near us was a tremendous gorge full of all sorts of herbaceous plants and magnificent trees. Columbines, larkspurs and the like were abundant. It was a forecast of the flower-garden I was to meet still higher. With Robert Ridgeway, the ornithologist I explored this gorge and took a bath in the icy stream which gave a part of its water to a rushing flume.

In the Franconia Valley of New Hampshire I remember the flowering raspberry is gay along the beautiful road to the Profile House; also up the path to Eagle Cliff on the Mt. Lafayette trail.

So, one after another, the beautiful scenes return to me, as I look at a herbarium sheet of *Rubus odoratus*. It is surprising how charming a dried specimen can be when it is associated with far off memories of lovely scenes and dear companions. It blooms again, as we look at it, with all its companion plants.

Providence, R. I.

THE AGGRESSIVENESS OF PLANTS.

BY WILLARD N. CLUTE.

ANY theory of evolution must of necessity include the idea of a struggle for existence; otherwise there would be no incentive for plants to develop the thousand and one marvelous adaptations that look toward the preservation and perfection of those best fitted to survive; but we must not too hastily conclude that this struggle for existence is always between plant and plant or even between the plant and its insect and fungous foes. There are numerous areas where little if any struggle of species with species seems to go on. In certain swamps, for instance, the irises, cat-tails, sedges and the marsh and sensitive ferns form communities which are apparently dominated by a live and let-live policy. Their habits of life are such as not to interfere with one another, while the nature of the habitat is such that other species cannot come in and start trouble.

The protection afforded many species of plants by their habitat is a subject that usually does not receive the amount of attention from plant students that its importance warrants. In some instances as in sand-barrens, there is room for many more plants than occur. The plants that are found in such regions are thrifty enough and the only reason that sand barrens are not more thickly populated seems to be the difficulty experienced by similar plants in getting started. The same is in a measure true of water plants which have nothing to fear from an invasion of the plants on the shore.

We may never know exactly how important the varying soil characteristics are in determining the habitats of plants, but that they are often the chief factors in the spread of certain species cannot be doubted. We are frequently at a loss to account for the aggressiveness or the lack of this quality in plants, unless we attribute it to the soil. There is probably not a single species of plant that, in a locality exactly suited to it, would not run out any other species. It is not mere aggressiveness in plants that, in a wild garden, determines which species shall survive and which shall perish. Change but the soil conditions and many of the dominant species would soon disappear. In planting a border of wild things we set but a single sprig of some things and soon have it in plenty, while other species, growing luxuriantly enough in the locality from which we brought them must constantly be attended if we would have them live. Since aggressiveness in plants is thus seen to be so largely a matter of soil and location, the intelligent gardener will exercise more than the usual amount of thought in the selection of a proper place for planting a new specimen. On a south bank it may persist and spread; on a northern slope it may dwindle and die. Its aggressiveness is not a matter entirely of constitution and heredity but rather of soil and situation and plant neighbors.

CENTENARY OF A BOTANIST.

Attention has lately been directed to the unusually large number of eminent men whose centenaries have been celebrated in 1909. To the list might be added Dr. A. W. Chapman, the botanist. Although he lived most of his life in a comparatively inaccessible place, and was personally known to but few people, he was for a long time the leading botanist in the South, as his contemporary, Dr. Asa Gray, was in the North. At least three biographical sketches of him have been published, but a brief outline of his life may be of interest to some of your readers.

Of English ancestry, he was born in Southhampton, Mass., Sept. 28, 1809. In his twenty-first year he graduated from Amherst College, where he had already displayed a decided talent for botany. The following year he moved to Georgia, where he spent four years, mostly teaching. He began the study of medicine in the office of a physician in Georgia, and received the decree of M. D. at Louisville, Ky., in 1836.

From Georgia Dr. Chapman went to Florida and practiced medicine, first at Quincy, then at Marianna, and finally at Apalachicola, where he spent the last fifty-two years of his life. Within a radius of 100 miles of Apalachicola, there are many species of plants which do not grow anywhere else in the world, and the meeting with these on his professional trips and holidays was doubtless a great stimulus to Dr. Chapman's botanical work. Very few botanists had visited those parts before, and many of the plants were unknown to science at the time he first saw them. At first he sent his novelties to Northern botanists to be studied and described, but the number finally became so large and the need of a manual of botany to cover the Southeastern States as Gray's "Manual" did the Northeastern so evident, that in 1860 he published a "Flora of the Southern United States," a work of over 600 pages, which remained the standard for the territory it covered for many years. Supplements were added to it in 1883 and 1892 to incorporate the notes and specimens sent in by botanists all over the South, as well as Dr. Chapman's own subsequent discoveries, and finally a completely revised edition was published in 1897 in the author's eighty-eighth year.

In these four books he described about 100 new species of plants, most of which were discovered by himself in Georgia and Florida. But for his extreme modesty and conservatism he might have described many more. The number of species discovered by him and described by others would probably bring the total of his discoveries pretty close to 200, a record which has seldom if ever been equaled in the North Temperate Zone. One genus of plants and at least a dozen species bear his name.

ORRIS ROOT.—The orris root so familiar to lovers of perfumes should really be called iris root since it is made from the roots, or rather rootstocks, of several species of iris, especially *Iris Germanica* the common blue flag of the gardens and *Iris Florentina* a white variety. It is reported that the root has to be dried and preserved for some time before the fragrance is fully developed. The freshly dug plants have no fragrance.

NOTE AND COMMENT

WANTED.—Short notes of interest to the general botanist are always in demand for this department. Our readers are invited to make this the place of publication for their shorter botanical items. The magazine is issued as soon as possible after the 15th of February, May, August and November.

DENSITY OF THE TROPICAL FOREST.—In temperate regions forty or fifty different species of trees is considered a good showing for the woodlands of a county or even larger area, while the trees themselves grew so scattered that plenty of light can sift down to the forest floor. In the tropics there is a decided difference. A writer in the *Philippine Journal of Science* states that in a piece of forest a little more than two acres in extent there was found, by actual count, eleven hundred and sixty trees representing eighty-five different species. These trees were all over twelve feet high and no account is taken of other vegetation. In such a forest, one must keep for the most part to the beaten path and cannot wander at will in search of botanical specimens.

SPORES OF FUNGI.—The spores of fungi, as with spores in genera, are very minute. This is doubtless a design to facilitate their dispersal since they are cast upon the wind and may float about for a long time before coming to rest. It is commonly known that they are very numerous, but just how numerous, few have any idea. A recent work on the fungi gives some most astonishing figures on this head. The common field mushroom produces two thousand million spores, but this performance is quite put in the shade by some of the shelf fungi which produce five times as many. The world's record for spore prduction seems likely always to remain with the giant puff-ball (*Lycoperdon giganteum*). A specimen of this enterprising species about twelve inches in diameter has been estimated to produce seven million million spores. Some of the larger specimens known must contain no less than 20,000,000,000,000 spores. Some other fungi may shed a million spores a minute and keep this up for several days. In view of this immense production of spores, the wonder is that fungi are not more numerous than they are. Suitable places for growth, however, are not very numerous and the same investigator reports that the chance of a spore alighting in a favorable place for germination is about one in 1,000,000,-000,000.

The Arctic Flora.—In exhibiting two recent collections of plants from Greenland and Ellesmere Land to the Torrey Botanical Club, Dr. Rydberg brought out several interesting facts relating to the flora of those ice-bound regions. There are about one hundred and fifty different species of plants north of the Arctic Circle and with the exception of the grasses and sedges, all of these are dicotyledons. One other monocot, *Tofieldia palustris,* is found in northern Greenland. Twenty-six families of plants are represented. Nearly all the plants are perennials with low and densely tufted stems and thick rootstocks. There are probably not half a dozen annual plants in the flora, and the woody species are scearcely more numerous. Of course there are no trees but there are several shrubs or rather bushes; among them the dwarf birch (*Betula flabellifolia*), three willows (*Salix groenlandica, S. anglorum* and *S. herbacea*), the crowberry (*Empetrum nigrum*), a blueberry (*Vaccinium uliginosum microphyllum*), *Cassiope tetra-*

gona and *Diapensia lapponica.* Most of the shrubs belong to the great heath family (*Ericaceae*) and several other members of this family extend nearly to the Arctic Circle notably marsh rosemary (*Andromeda polifolia*), Mountain heath (*Phyllodoce coerulea*), Labrador tea (*Ledum decumbens*), Lapland rose bay (*Rhodendron lapponicum*), trailing azalea (*Chamaecistus procumbens*) and *Cassiope hypnoides.* More than three fifths of the plants are circumpolar, that is, they are found in all lands that extend into Arctic regions.

New Conception of a Sub-species.—If one is not too intimately concerned in the battles of the species-makers, there is not a little amusement to be obtained from the curious claims that are often made to bolster up shaky "species." All such will be interested in the following note from *Muhlenbergia* in reference to a prairie sunflower. "An Illinois botanist, some years ago, finding some differences in pubescence and intranodal separation among the sunflowers referred to *Helianthus occidentalis,* considered these of sufficient importance to require the segregation of a part under the name of *Helianthus Illinoensis.* Quite recently, another student, by careful observation, was able to demonstrate that this segregate was simply a condition, due mainly to hydrodynamic causes. He discovered that plants, which in spring and early summer were *H. Illinoensis,* were at the time of blooming and fruiting, simply *H. occidentalis.* Most botanists, having established this fact, would have contented themselves with reducing the segregate to synonomy and noting under the species its variations under certain conditions. In the present case, however, the investigator 'proposes that these plants should bear the name *Helianthus occidentalis illinoensis,* comb. nov.' It would be more in accordance with the facts that they should bear that name 'in the spring and early summer' but that in the fall they should be called simply *Helianthus occidentalis*. It seems, then, that there are botanists who hold that a species and a sub-species may grow from the same root and on the same stem, at different seasons; may, indeed, gradually pass from one category to the other as the year rolls by. What boundless possibilities do such conceptions open up. What a multitude of plants must be provided with sub-species. The case is especially strong for those trees which have very different juvenile and adult foliage. In fact, why is not the bean of early spring showing only its cotyledons a good sub-species of the very different plant which later in the season, under the stimulus of nutriment moisture and light succeeds it at the time of blooming and fruiting?

AGGRESSIVE PLANTS.—It seems to me that we too often err on the side of making phenomena more simple than they really are. Plants are vastly more complex organisms than our formulated ideas recognize. Many of their phenomena completely baffle us. For example, I might mention what has been called aggressiveness in a plant namely, its ability not only to occupy and maintain the soil but to spread and crowd out other plants. This is particularly evident in plants introduced from one country into another. Thus nearly all our weeds are of Old World origin. The same is true of our permanent meadow and pasture plants, where ability to occupy and hold the ground against weeds is essential. In this respect our American grasses and clovers utterly fail before the foreign immigrant. Some other striking instances of the great aggressiveness of an immigrant may be cited. The introduced English violet is said to be one of the worst weeds in Mauritius; American cacti are becoming a pest in South Africa; the marvelous vigor and spread of the American water weed (*Elodea*) under European conditions is well known.

Several explanations of these and other phenomena have been advanced. The commonest one is that the plant is introduced but its fungous and insect enemies are not. Therefore the plant is released from all handicaps as it were and can exercise to the utmost its inherent energy. A second and related explanation is that every plant becomes held within limits by the competition of other plants in its native land and very often in the new environment the native plants do not have an equal restraining influence—because they have had to contend with a different set of competitors A third idea is that any organism with the ability to spread at all becomes more energetic through the constant mixing of blood of the advancing population. All these ideas are interesting, but difficult if not impossible of experimental proof. The last suggestion receives some support from the fact that many weeds and other organisms run out after they have ceased to spread. The recent examples of the Russian thistle and the prickly lettuce are familiar cases. Such phenomena may be due wholly or in part to increase in enemies, but in many cases like the two cited there is not one iota of positive evidence. I think we ought to give such phenomena more consideration as they reveal traits in plants that transcent all our sterotyped and inadequate theories. The old gardener often treats his plants as if he regarded them as sentient beings. Perhaps we err in considering them too much machines.—*C. V. Piper in Science.*

Natures Planting.—When planting our flower gardens we rarely plant as thickly or mix things up as thoroughly, as Nature does in her wild planting. A writer in the *Garden Magazine* notes that in a single square foot of prairie sod he found five shooting stars, one purple rudbeckia, six spikes of phlox, three wild hyacinths, one aster, five clumps of blue-eyed grass, two clumps of yellow star-grass and one clump of bird's-foot violet besides other unrecognized weeds. Certainly plants can grow and thrive under conditions that would be thought anything but ideal in a flower garden. From what we know of selective absorption by plants it seems likely that a variety of plants have a better chance of growing in close proximity than a pure stand of a single species. Possibly we could plant our flower gardens in this way with good results.

Vitality of Pine Seeds.—It is well known that various species of pine in the Western United States retain their cones and seeds for a number of years after the seeds are mature. Sometimes these cones remain on the tree for nearly twenty years. The question having arisen as to the vitality of the seeds in such aged cones, several experiments have been made in order to settle the matter. J. C. Blumer experimented with six thousand seeds and found the older seeds not only as viable as the younger ones but more so. Out of three thousand from ten to thirty years old, 40% retained their vitality, while of a similar number of seeds les than ten years old, only 31% grew. The advantage of this prolonged vitality is that it gives the trees a distribution in time similar to the distribution in space of other trees. A forest of such pines may thus be reproduced in a locality more than thirty years after the last living specimens have disappeared.

Plant Hairs and Nitrogen.—We have many theories and some facts to account for the uses of plant hairs but nobody is sure that we have arrived at a correct solution of the problem. Plant hairs may prevent the clogging of stomata by rain or dew, or they may absorb water on occasion; they may protect from evaporation by shading the leaves, they may afford a partial defence against sudden changes of temperature and they may protect in a measure from the attacks of grazing animals but whether these are their principal uses we cannot be sure. Recently botanists have been asserting that the epidermal hairs of many plants are useful in obtaining free nitrogen from the air. Up to very recent times we have been taught that practically all the nitrogen in plants is taken from the soil in the form of nitrates but the investigations of several Old World botanists put a new face on the matter. It has been known for some time that forest soils steadily gain in nitrogen content from the decay of the leaves of trees which seems to give additional evidence in favor of the new theory, but further investigations must be made before the idea is likely to be accepted by botanists.

Forms of Kalmia.—When one begins the intensive study of any species of plant there seems to be no limit to the number of forms that may be discovered. These forms are of interest to the breeder and the student of evolution and if not seized upon by the species-maker to further complicate the nomenclature of the subject, are worth taking into account. Practically any species of plant may be shown to have these forms; even the nearly inflexible calico bush (*Kalmia latifolia*) has several that bear latin names. *Polyptala* has partly double flowers, *alba* has white flowers, *rubra* has deep pink flowers, *fuscata* has flowers with a broad brownish purple band inside, *Myrtifolia* has small leaves and forms a dense and compact bush, and *obtusata* has obtuse leaves. These, of course are mere variations from the normal and even their describers had no idea that they are distinct or permanent forms. Anyone who chooses may describe a similar set of forms of other plants. So long as all our plants are not thus divided the study of botany, wil not be greatly hampered by the added names and a few species-makers may derive enjoyment from the results.

SCHOOL BOTANY

TEACHING SYSTEMATIC BOTANY.

THE teaching of systematinc botany may easily get into a rut, although there are sufficient variations in the way it may be taught to give the teacher some choice of the rut into which he may fall. The objects in teaching this subject at all are three in number: to make the pupil familiar with the names of our plants, to teach him something of relationship and the use of a key, and to develop in him some of the ability to judge and compare that is essential in any walk of life. To the writer it seems rather a waste of time to spend any considerable part of the school year in memorizing definitions, and exceedingly foolish to set the pupil at such purely mechanical tasks as "analyzing" flowers. If the pupil has had no previous contact with plants, a part of his time may be well taken up with a study of seeds, stems, roots, leaves, flowers and fruits, but not with the end in view of learning the descriptive terms that may be applied to them. He needs first of all to know what these organs are for, and how they work. The technical terms needed for systematic work can be learned in two or three days, and if not the pupil has a glossary which he can consult. An ideal pre-requisite to a course in systematic botany is a thorough study of the plant as a living thing.

The ability to make good herbarium specimens is a thing to be desired, but this ability is not fostered by a miscellaneous collection of tops secured in the effort to get fifty different flowers. The pressing and mounting of these plants is waste time—"busy work"—such as the teachers in the lower grades are wont to give their children to keep them quiet and out of mischief. Here and there in your classes a real botanist will develop who will learn to press plants with your assistance or in spite of it. Only such needs to be encouraged to form an herbarium.

Usually flowers are abundant during only the last few weeks in the term and the temptation is always great to crowd the work in order to secure as many flowers as possible. This seems to be a mistake. Too frequently teachers fail to interest the pupils in the flowers themselves, the securing of the scientific name apparently being the end and aim of the pupil's endeavors. This doubtless accounts for the fact that nine-tenths of our botany students cease the use of a manual as soon as school is out. It is very desirable, after the name of a plant is learned, to investigate into its habits a bit; to discover what insects pollinate it, how its seeds are distributed and its methods of attracting insects and other guests.

Unusual effort should be bent upon the task of convincing the pupil that the end and aim of the course is not the securing of the specific name. Some,—nay many—are never convinced and find the index always more attractive than the key. Others there are who disdain all help from index or classmates and take pride in working out the plants for themselves. These may be early separated from the rest of the class and allowed to go it alone. Usually at the end of the season they will be found far ahead of the work required of the rest. From pupils such as these come the real botanists.

How to convince the searcher of the index that the key is better is often a difficult matter. Certain schemes, however, may help to hold him to his work. He may be required to write out the main heads of the key as he goes along as a guarantee that he has really named his plant by that means. Another feature that needs to be discouraged is the copying that invariably goes on by the weaker students. When one is sure of the name of his species, it is often surprising how rapidly the information diffuses through the class. One way to overcome this is to require the name of the given flower, when found, to be written down on a slip of paper and handed in, and the slips not corrected until the end of the period. In this way the pupil is taught to rely on himself and if he is marked according to his work, he may be induced to become an independent student.

But the teacher's work is only half done if the pupil is left with a slavish dependence upon either key or index. He should early be taught to recognize plant relationships. Many of these he has recognized without a botany—the violets, umbelifers, and composites, for instance—and he should soon be able to recognize with equal ease, the crucifers, legumes, lilies, borageworts, roseworts, mints and many others. It is not expected that he will keep the characteristics of the small families in mind, but he ought to have a sufficient knowledge of plant-relationships to perceive the great families to which they are allied.

Lastly a good manual is essential to a first class course. No pupil should be encouraged to neglect the weeds and other plants with inconspicuous blooms by giving him a book containing only the showy flowers. He needs a book that he can depend upon, one that he knows contains his plant which may be run down by a careful search. How discouraging it is, after a long and honest effort, to be told that his species is not in the book, next time he will doubtless draw this conclusion at the first indication of difficulty. By the use of a complete manual, and a sensible course, he may be turned out an intelligent botanist instead of a mere repository of latin terms that will be forgotten as soon as school is out.

THE NEED OF SCIENCE —The physician, the scientist, the engineer, etc., must acquire the necessary knowledge and skill in the course of his special studies. The jurist ,the philologist or the theologian who has not acquired these extremely important elements while at school, will later find no opportunity for getting them and run the constant risk of atoning for his shortcoming through unpleasant or even dangerous experiences with his own person. What naive ideas on matters of hygeine, chemistry and physics does not one meet with in the lives of jurist and linguists. There is here evident a serious defect in our choice of the educative material in the schools and in the application to the needs of civilized life. Science teaching in the high school is demanded, not for the training of those who are to enter scientific professions, but for the training of just those who do not select a medical or scientific course.—*Max Verworn in School Science.*

TEACHING BOTANY.—It is no easy matter to teach high school botany well. Unless the instructor knows a good deal about plants; what they are, how they are built, what they do, and how and (partly) why they do it, and knows fairly well what his pupils are seeing and what they are thinking about, he will accomplish little. Most of us have known dozens of botany teachers but we could count the superemely successful ones—in school or college—on the fingers of one hand. If the time should ever come when most secondary schools are willing to devote at least a year to botany, to give all reasonable facilities to teachers of the subject and in turn to demand of them as adequate preparation as is required of a teacher of Latin or geometry in a first rate fitting school, we would surely find that the educational value of botany is greater than most of us have ever ventured to rate it.—*Prof. J. Y. Bergen, in School Science.*

KEY TO THE FAMILIES OF THE SYMPETALOUS DICOTYLEDONES.

1 Stamens more numerous than the corolla lobes (2).
  2 Stamen filaments distinct.
      Flowers perfect; style one. — Ericaceae. (G. 626. B. 692).
      Flowers seldom perfect; styles four. — Ebenaceae. (G. 648. B. 721)
  2 Stamen filaments more or less united (3).
    3 Stamens ten or fewer.
      Filaments united into two equal sets. — Fumariaceae. (G. 416. B. 437)
      Filaments united into a split tube around the style. — Leguminosae. G. 500. B. 523)
    3 Stamens more than ten.
      Filaments united into a tube about the styles. — Malvaceae. (G. 566. B. 617)
      Filaments united only at base into one or more sets.
        Calyx free from ovary. — Trenstroemiaceae. (G. 570. B. 523)
        Calyx adherent at least at base. — Styracaceae. (G. 649. B. 722)
1 Stamens fewer than the corolla lobes or of the same number (4).
    4 Ovary inferior, adherent to the calyx tube (5).
      5 Stamens cohering by their anthers.
          Flowers in an involucrate head. — Compositae. (G. 770. B. 889, 913)
          Flowers not in a head.
            Corolla regular; flowers imperfect; vines. — Cucurbitaceae. G. 764. B. 881)
            Corolla irregular; flowers perfect; herbs. — Lobeliaceae. (G. 768. B. 887)
      5 Stamens entirely distinct.
          Leaves alternate; flowers regular. — Campanulaceae. (G. 765. B. 883)
          Leaves opposite.
            Stipulate or verticillate. — Rubiaceae. (G. 746. B. 860)
            Exstipulate.
            Ovary two to five celled. — Caprifoliaceae (G. 754. B 869)
            Ovary one-celled.
              Stamens two or three. — Valerianaceae (G. 761. B. 876)
              Stamens four. — Dipsaceae (G. 763. B. 880)
    4 Ovary superior, free from the calyx tube (6).
        6 Flowers irregular (7).
          7 Ovary deeply four-parted.
              Leaves opposite, stem square. — Labiatae. G. 690. B. 779)
              Leaves alternate, stem round. — Borraginaceae. (G. 679. B. 766)
          7 Ovary entire (8).
            8 Four ovuled, four or fewer seeded. — Verbenaceae. (G. 688. B. 776)
            8 Many ovuled several or many seeded (9).
              9 Trees, shrubs or vines.
                  Seeds not winged. — Ericaceae. (G. 626. B. 692)
                  Seeds winged.
                    Flowers violet-colored. — Scrophulariaceae. (G. 717. B. 818)
                    Flowers not violet colored. — Bignoniaceae. (G. 740. B. 850)
              9 Herbs.
                  Leafless parasites. — Orobanchaceae. (G. 739. B. 848)
                  Leafy, not parasites.
                    Fruit one-celled; leaves at base. — Lentibulariaceae. (G. 736. B. 845)
                    Fruit more than one celled.
                      Seeds borne on hooks. — Acanthaceae. (G. 742. B. 853)
                      Seeds not on hooks.
                        Corolla imbricate. — Scrophulariaceae. (G. 717. B. 818)
                        Corolla valvate or plicate. — Solanaceae. (G 712. B. 809)

6 Flowers regular (10).	
10 Stamens two; shrubs.	Oleaceae. (G. 650. B. 723)
10 Stamens more than two (11).	
11 Opposite the corrolla lobes.	
Trees or shrubs.	Sapotaceae. (G. 648. B. 720)
Herbs.	
Styles five, ovary one-seeded.	Plumbaginaceae. (G. 643. B. 719)
Style one, ovary many seeded.	Primulaceae. (G. 643. B. 713)
11 Alternate with the corolla lobes (12).	
12 Shrubs and trees.	
Style none.	Aquifoliaceae. G. 554. B. 602)
Style one.	
Fruit a four-seeded drupe.	Verbenaceae. (G. 679. B. 766)
Fruit a many seeded capsule.	Ericaceae. (G. 626. B. 692)
12 Herbs (13).	
13 Ovary one (14).	
14 One-celled.	
Ovules one.	Nyctaginaceae. (G. 375. B. 382)
Ovules several.	
Leaves cleft or lobed.	Hydrophyllaceae. (G. 676. B. 762)
Leaves entire.	
Flowers in spikes.	Plantaginaceae. (G. 743. B. 856)
Flowers not in spikes.	Gentianaceae. (G. 654. B. 728)
14 Two or more celled.	
Plants leafy at base only.	Plantaginaceae. (G. 743. B. 856)
Plants with leafy stems.	
Ovary three-celled.	Polemoniaceae. (G. 673. B. 756)
Ovary two-celled.	
Leaves opposite.	Loganiaceae. (G. 652. B. 726)
Leaves alternate.	
Stem twining.	Convolvulaceae. (G. 668. B. 749)
Stem not twining.	
Seeds four.	Borraginaceae. (G. 679. B. 766)
Seeds many.	
Style one.	Solanaceae. (G. 712. B. 809)
Styles two.	Hydrophyllaceae. (G. 676. B. 762)
13 Ovaries two, or one deeply four parted.	
Stigmas not connate.	Borraginaceae. (G. 679. B. 766)
Stigmas connate.	
Petals convolute.	Apocynaceae. (G. 661. B. 737)
Petals valvate.	Asclepiadaceae. (G. 663. B. 740)

FRAGRANT ARBUTUS.—In reference to the statement in a recent number that arbutus (*Epigaea repens*) is not fragrant in the South, Mrs. G. W. Sirrine, writes that in the vicinity of Greenville, South Carolina, it is delightfully fragrant.

EDITORIAL

The plant collector or flower lover is rarely concerned about the kind of botany that is taught in the public schools but it would be well for him to keep in touch with such matters if only for the view it gives him of his own part of the science. Botanical science has broadened so rapidly that any one of half a dozen divisions of it may now engage the attention of the student for a lifetime. As a consequence educators are not at all agreed as to what is best to teach as "botany" in the High School. The teachers range all the way from those who teach the science for the purpose of "developing, strengthening and disciplining the intellect" without regard to what the pupils may learn about plants to teachers who endeavor to give the pupil a good knowledge of plants and at the end of the course to leave him not only with the ability but inclination to continue the study.

* * *

It scarcely need be said, however, that botanical instruction in the schools, is not intended to make botanists of the pupils. Rather it is to give them a knowledge of the underlying principles of the science. It would surprise many a plant collector to find how small a part the collecting and identifying of flowering plants plays in real botanical teaching. Time was when "botany" meant simply learning the names of the parts of a plant, the "analyzing" of a few flowers and the making of an herbarium of a certain number of specimens. This no doubt accounts for the assumption by many plant collectors that because they can identify plants they are botanists. In the days we speak of, laboratory work in botany was scarcely known in the high school and field work, aside from gathering flowers had no existence.

When the reaction from flower analysis came, the majority went in for physiological and morphological botany, until this side of the subject in some institutions, became as much over done as was the other. Pupils left school after a course in botany with certain ideas about plants it is true, but incapable of distinguishing a dandelion from a daisy or of finding out how to do so. To them the wonderful features of plant life were so much vegetation and nothing more.

* * *

There are teachers. however, who still insist that the boy or girl who has had botany in school should be able, later in life to recognize noxious weeds at sight, to make a botanical specimen that can be identified by the nearest agricultural experiment station when they turn to it for help, to know a poisonous plant from a harmless one, and last but not least, to be familiar with the more noticeable species of herbs. shrubs and trees in their vicinity. The need for such knowledge is urged not solely upon the grounds of utility, though utility alone is sufficient, but because of the simple delights that an acquaintance with the flowers adds to life.

* * *

BOOKS AND WRITERS.

"Who's Who Among the Ferns" is the title under which W. J. Beecroft has issued a series of drawings of our native ferns with short discriptions of their form, range and time of fruiting. The book is a small 12mo. intended for use in the field, and is published by Moffat, Yard & Co., at $1.00 net.

Many of our readers still remember with pleasure the regular visits of *Meehans' Monthly* and regret its untimely end. After the lapse of some years the house of Meehan has again entered the publishing field. This time it is an excellent monthly publication named *Meehans' Garden Bulletin.* This is evidently designed primarily to augment the sales of the Meehan nurseries, but its pages contain a wealth of practical information on gardening subjects that everyone who loves plants will be glad to have. It was begun in September 1909 and is edited by S. Mendelson Meehan. We wish the magazine all success.

A series of booklets, each devoted to a single tree species, has been begun by Sarah W. Maury. Three numbers devoted to the Beech, the Gingko and the Holly respectively have already appeared. These are small square volumes bound in attractive stiff covers and quite appropriate for use on arbor days and the like. Each is well illustrated partly in color and the text sets forth the merits of the subject in an interesting way. We shall welcome a full series if as well done as the early numbers. The booklets are published by the John Lane Company, at New York, at 30 cents each, postpaid.

Fernow's "The Care of Trees in Lawn and Park" recently issued by Henry Holt & Co., bear some of the ear-marks of a book made to order. The author says in the preface that it was due largely to accident that it was compiled and elsewhere in the book, authority for various parts are disclaimed. After a careful reading of the book, however, the reviewer finds little that needs apology. The author is professor of Forestry in the University of Toronto and thoroughly informed on his subject and aside from a rather halting literary style, has made a very good volume. About two-thirds of the nearly four hundred pages are devoted to the diseases of trees, whether caused by insects, fungi, soil conditions, or due to obnoxious gases, electricity or mechanical injuries, and the improvement of trees by fertilizing, pruning, etc. The remainder of the book is taken up with lists of trees and shrubs commonly planted with notes on their habitats, appearance and other characteristics. There are upwards of one hundred illustrations. The book sells for $2.00 net.

The J. B. Lippincott Company has selected certain parts of Prof. Scott Elliot's "The Romance of Plant Life" to form one of the books in their "Wonder Series" under the title of "The Wonders of the Plant World." Since the book is of British origin and intended primarily for British readers it will be of less value on this side, nevertheless the amateur botanist, interested in the curious things about plants will find much to his taste in the book. Such titles as Flowers, Forests, Scrub, Deserts, Activity of Vegetables, and Story of the fields, will indicate its scope. The text is very well written but the facts detailed seem in many cases rather jumbled together. The book covers about 150 pages and sells for 75 cents.

The names of Hilgard and Osterhout on the title page of a work devoted to "Agriculture for Schools of the Pacific Slope" is sufficient guarantee that it is both scientifically accurate and up-to-date. It must be the reviewer's task to discuss the arrangement and scope of the book. In this there is much to commend. The early chapters discuss the plants needs and how they are satisfied, the origin of the soil, cultivation, propagation, grafting, etc., and then follow others on insect pests, plant diseases, field crops, and the like. Farm animals are briefly discussed, forcasting the weather is explained and some attention is gives to forestry. Even human physiology comes in for some pages. At first glance the book seems rather too extensive for a season's course, but it has been the design of the authors to give more than is needed for a single course and allow each teacher to select such parts as are suited to the locality. The one thing that militates against the use of this book in schools is the fact that the text is entirely descriptive with no directions for pupil or teacher for practice work. If agriculture is to be introduced into our public schools, it should be the aim if every teacher to get as far away from "book-farming" as possible. It cannot be denied that the beginner must have books that describe many of the things with which he will later become familiar in practice but the mere recitation of a text relating to agriculture is not agriculture in any worthy sense. It is to be hoped that the authors, who are especially fitted for the task, will later give us a manual for practical work to accompany their excellent text. The book contains more than two hundred illustrations making it further attractive to the young student. Since the main features of agriculture do not vary much with the region, all who are interested in any phase if the subject will find this a very useful book. It is published by the MacMillan Company at $1.20 net.

As the diseases of plants have become better known there has grown a need for an authorative book on the subject. This has now been supplied by B. M. Duggar's "Fungous Diseases of Plants." The book is one of the most complete and satisfactory volumes that we have seen. It begins with nearly fifty pages devoted to culture methods and the technique of handling and staining. This and the next few pages on Physiological Relations will be chiefly of interest to the student and investigator but the remainder of the book, some four hundred pages is a practical treatise in the diseases of plants in which each form is discused with regard to its occurrence, symptoms, the fungus that causes it, and methods of control. Copious citations of literature of the subject make it easy for any who desire to go fully into any phase of the subject. From the book we learn that plant diseases are caused by a vast number of fungi coming from all the classes of these plants. The ascomycetes and the fungi imperfecti furnish by far the largest number of organizations causing diseases in plants but the basidiomycetes are not far behind. The bacteria supply a comparatively small number of harmful species. The book is well and extensively illustrated and written in a style that any farmer can undertsand though it is thoroughly scientific is every respect and is designed to serve as a text book for universities and colleges. A host index renders it possible for the student to readily discover the nature of a given disease in his crops. The volume is published by Ginn & Co., at $2.00.

The question of the fertility of the soil and how to maintain it is one of paramount importance to every farmer and therefore to the rest of us who depend upon the farmer for food. In recent years the theory that there is in most soils a sufficiency of the chemicals needed by plants for all time, has been stoutly argued and as stoutly combatted by those who believe that soils can be worn out and must be improved by fertilizers. A notable contribution to the discussion is "Soil Fertility and Permanent Agriculture" by C. G. Hopkins well known for his work in soil chemistry at the Illinois Experiment Station. Dr. Hopkins is on the side of those who advocate the improvement of our soils by fertilizers and takes no uncertain stand on the subject. In his book he goes very extensively into the chemistry of soils, the sources of plant food and crop requirements, and draws his conclusion in favor of fertilizers. Much space is also given to detailed accounts of soil investigations in this country and abroad and the factors in soil fertility are carefully analyzed. However much the two schools may differ, as to the effect of fertilizers, they agree in this, that good crops cannot be grown indefinitely on any soil without them. Whether they are needed, as Dr. Hopkins contends, to supply an actual lack in the soil, or whether, as his opponents assert, they are useful to plants only as they enable them to neutrolize various toxic elements in the soil, is a question that apparently cannot be decided at present. If manures are necessary to keep the plant food in the soil at its highest state, it is difficult to account for the fertility of most virgin soils, while the fact that certain plants are undoubtedly toxic to certain others when grown in their vicinity seems to bear out the contention that one of the functions of fertilizers is to neutralize these toxic elements in the soil. Be this as it may the present book is a very clear and comprehensive account of Dr. Hopkins' investigations and conclusions and must be taken into account by all who are concerned in improving the land. It is an octavo of more than 650 pages and is published by Ginn & Co.. at $2.75.

Beecroft's "Who's Who Among the Wildflowers" is another little volume designed to aid the beginner in naming the commoner wildflowers. It arranges the plants according to color and presents a succession of drawings with brief descriptions of the plant its range and time of blooming. Part of each descriptive page is reserved for notes. Many of the drawings are evidently taken frim other works but many serve the purpose of giving an idea of the flower. The lack of any popular information about the different species represented will be felt by those who are desirous of knowing more about the plant than its mere name indicates. The book, however, costs less than other works of similar nature and will doubtless be welcomed by many who are interested in the wild flowers. The book is published by Moffat, Yard & Co., of New York, at $1.20 net.

Often in turning the leaves of the seedman's catalogue we have wished for a book that would tell us of these garden flowers much as the popular flower-guides tell us of our common wildowers. It is with special delight, then, that we turn to the newly issued "Our Garden Flowers" by Harriet L. Keller only to find with regret that the author has failed to perform her self-imposed task successfully. Garden flowers in abundance the book contains. but the very flowers of which we know least and would fain know more, are missing. For instance, the common yellow and the orange day lilies (*Hemerocallis*) are described but not a wort is said about the copper-colored relative of these, or that later lemon lily of August. Cases of this kind could be multiplied indefinitely. On the other hand, we find described such insignificent weeds as the chickweed, mallow, and purslane, and garden vegetables like the beet and spinach. For the sake of more flowers we would willingly dispense with the vile weeds and well known pot-herbs. We hope the author, or someone else will have another try at this subject. So far as the book goes into the subject, however, it is excellent, having much the appearance of other popular manuals with the important features of leaf and flower indicated with more or less matter of a general nature following. The reviewer likes the book but regrets its incompleteness. As it is, it runs to 550 pages and nearly 300 illustrations. It is published by Chas. Scribner's Sons, New York.

The authors of "The School Garden Book," Messrs. Weed and Emerson, define the school garden as any garden in which a boy or girl of school age is interested. By this definition they have an extensive field from which to cull the material for their book and while they have presented us with a useful reference work destined to be consulted frequently by the young gardener it can in no sense be considered as a practical manual of gardening for schools. After an introduction of some twenty pages addressed primarily to the teacher there are twelve chapters named for the month beginning with September. In these, in addition to the discussion of flowers that are usually common in such months, or are planted then, there is more or less matter on preparing the soil, selecting seed, cotyledons. structure of flowers and the like. This part is largely descriptive and still appears to have the teacher in view. The concluding pages contain a series of garden exercises for pupils in which they are directed in the work of planting and cultivating plants, and required to draw various parts, make records of their growth and write up their experiences. The book can scarcely be used as the basis for the school garden course but it will offer many helpful suggestions. The book is published by Chas. Scribner's Sons, New York.

The "New Manual of Rocky Mounain Botany" by Coulter and Nelson is likely to prove most satisfactory to the great majority of botanical students. It is practically a new book, having been entirely re-written, but the treatment is essentially that of the earlier volume. It is perhaps unadvisable for one not familiar with the Rocky Mountain flora to pronounce upon the treatment of species and varieties. The fact that the author, notwithstanding somewhat radical views, has reduced to synonony nearly eighteen hundred species indicates that, at least a middle course has been followed. The nomenclature is according to the Vienna rules ensuring something like stability to this phase of the work. There are also excellent keys to all the genera and species placed at the beginning of each genus where they should be and not scattered among the descriptions of species. Unusual features are the placing of the common name at the end of the description of the species and the citation of the place of publication of all the specific names. The book, like the earlier one is published by the American Book Company.

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WILLARD N. CLUTE ❧ ❧ ❧ EDITOR

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PICKEREL WEED AND BURR REED IN COLD POND.

THE AMERICAN BOTANIST

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"Summer ebbs, each day that follows
Is a reflex from on high,
Tending to the darksome hollows
Where the frosts of winter lie."

—Wordsworth.

SOME RARE VERMONT PLANTS.

By Leston A. Wheeler.

ONE morning the latter part of July with my faithful horse I left our Townshend home and drove up through the beautiful valley of West River to Jamaica. Here we met our friend, and proceeded on, over the hills, to Cold Pond, a fair sized sheet of water lying in a remote corner of the town. West River valley is not only beautiful but it is interesting, especially to the botanical student, as along its shores are to be found some of the rarer Vermont plants. Here is seen in great abundance burnet (*Poterium canadensis*) which is found nowhere else in the state, so far as the writer knows, sand cherry (*Prunus pumila*) found elsewhere only in the Lake Champlain and Connecticut river valleys, billberry (*Vaccinium caespitosum*) reported from Washington and Mt. Mansfield's Chin, and tubercled orchis (*Habenaria flava*) common only in favored haunts.

We left our horse in a friendly barn at Winhall Station and took our press, vasculum, kodak and lunch and tramped the remaining mile to our destination. We were delayed somewhat at the depot by several railroad immigrants among which were carpet weed (*Mollugo verticillata*), tumble mustard (*Sisymbrium altissimum*), and sand spurry

(*Spergularia rubra*) a Vermont rarity being found only in three other places in the state up to the publication of the "Flora" in 1900.

We found the road to the pond much better than we had been led to expect. An old farm at the end of this road was being "hayed" by some men who kindly directed us to the pond lying hidden in the woods near by. As we came out on the shore at the "landing" (if an old log or two and a half submerged boat might be so termed) we stopped for a few minutes to take in some of the beauties of the scene as well as to plan our visit further. The pond is of an irregular pear shape with a sharp bend near the neck so that the smaller end lies toward the south while the larger end, from which flows a small stream, lies to the eastward. There is no inlet, the bogs about its shore showing it to be fed by springs. The day was fine and not uncomfortably warm, with a fresh breeze keeping the water in almost constant motion and causing it to sparkle enchantingly in the sunlight. The deep shadows under the overhanging trees on the shore were in pleasing contrast with the shining open water while the surrounding forest-clad hills formed a beautiful background for the picture.

Various aquatic plants about the landing arrested our attention. Pickerel weed (*Poniedera cordata*), although by no means rare to the state, was new to me and I was much pleased with its beauty. It is growing in this pond in considerable abundance in company with burr reed (*Sparganium*). *Lobelia Dortmanna* was common in the more gravelly portions; this being the third pond in Windham county where I have seen it. The others are Grout pond in Stratton and Sunset lake in Marlboro. Floating heart (*Nymphoides lacunosum*) was common; also the yellow pond lily (*Nymphara advena*). Well out from the shore where they were literally "rocked in the cradle of the deep" were the beautiful, fragrant blooms of the white water lily (*Castalia odorata*). Neither water shield

(*Brasenia peltata*) nor *Potamogeton* were common in this pond.

There being no serviceable boat at hand we decided that a tramp around the shore gave the greatest promise of success and this plan we proceeded to carry out. We found a path nearly all of the way near the shore which we followed, pausing now and then, as some plant especially attracted our attention, or to take a picture.

It would make a long story, as well as an uninteresting one to attempt to enumerate all of the plants which we saw on our way; therefore with the mention of a few of the most prominent ones I will leave to the imagination of the reader the task of filling up the many interstices of that stroll in the woods near the water's edge. The pink lady's-slipper (*Cypripedium acaule*) showed by its many scapes what it had been doing in its own allotted season while the large purple fringed orchis (*Habenaria fimbriata*) gave one almost perfect spike and many that were in various stages of fruitage. *H. clavellata* was very abundant and showed some of the largest blooms that I ever saw; but of the tall white orchis (*H. dilatata*) we saw not one. Among the ferns we saw *Nephrodium cristatum* and its variety *Clintonianum* as well as an abundance of *Osmunda, Onoclea,* etc. There was quite a quantity of wild calla (*Calla palustris*) along a portion of the shore. A few plants of *Rosa blanda* were found at the southern end of the pond. The most noticeable shrubs were the swamp pink (*Rhododendron nudiflorum*), the mountain holly (*Nemopanthus mucronata*) with its crimson berries in great profusion, and the blueberries (*Vaccinium pennsylvanicum, V. vacillans* and *V. corymbosum*); the first on a dry knoll opposite the landing where we ate our lunch among the remains of old camps. In the bogs around the outlet we found quite a quantity of the small cranberry (*V. oxycoccus*).

As we approached the eastern end of the pond after lunch we startled up a pair of herons who manifested their displeasure at our intrusion of their private dining room by hoarse croakings as they flew to their forest home. When we arrived at that part of the shore from whence they had taken their departure we found the mud well covered with their tracks where they had been searching for the fat tadpoles which abounded all about the pond in the shallower water.

About the lower end are small bogs which proved productive ground for us. Here was the pitcher plant (*Saracenia purpurea*) and sundew (*Drosera rotundifolia* and *D. longifolia*) the latter being collected for the first time by either of us as it is not generally common in Vermont although Windham county seems to be the most favored portion in this respect. *Pogonia ophioglossoides* was abundant in the sphagnum but we looked in vain for signs of its companions the *Arethusa* and *Calopogon*. The seven angled pipe-wort (*Eriocaulon articulatum*) was found here among many other marsh loving plants. The most important find of these bogs, if not of the day, was the yellow-eyed grass (*Xyris montana*) which was not only new to us but so far as the writer can learn is new to the state. The first colony we found was small but a few minutes later we found another bog where is was very plentiful over a small area.

The hour for departure came far too soon to permit of anything like a thorough study of the plant life about the pond for as we were far from home we had to leave early; so with a good-bye shot with the camera we wended our way back to the haunts of men. As I was driving down the valley after leaving my friend at Jamaica I saw, just as the dusk was beginning to lower, a doe with her two spotted fawns beside the road and as they did not seem afraid I stopped and watched them for a few moments. The beautiful scene seemed to give a parting blessing to the day's pleasure.

Townshend, Vermont.

PARNASSIA.

By Dr. W. W. Bailey.

THE plants of the Saxifrage family, to which old Dioscorides gave the name of grass of Parnassus, well deserves its divine title. It is easy to fancy it growing on the heights affected by the gods on the border of cloud-fed ponds.

The beginner who first discovers its large and showy flowers in late autumn, thinks at first that he has found a new anemone. The five white petals, veined with delicate green or yellowish lines, suggests that genus. Examination, however, shows that our plant, unlike an anemone, has both calyx and corolla, the sepals sometimes slightly united at base.

Within the petals and at the base of each is a cluster of sterile filaments tipped by glands. These secrete no nectar, but Kerner tells us they deceive flies into approaching them and thus getting dusted with the pollen of the five neighboring proper stamens which is then borne to the pistils of other flowers of the same species. Some of our many young students might do well to study any of our four species keeping this matter in view.

Parnassia Caroliniana, the one with which the writer is acquainted, blooms at the time when the fringed gential is prevalent and the maidens' tresses (*Spiranthes cernua*) fills the air with its delicate fragrance. The species *palustris* occurs also in Europe while *P. asarifolia* is restricted to the high mountains of Virginia and North Carolina.

This pretty genus seems to intensify the feeling one has of the very heterogeneous character of the Saxifragaceae. It includes shrubs like *Ribes* and *Philadelphus,* herbs with solitary flowers like *Parnassia* and others with definite panicles like *Heuchera* and *Saxifraga.* However, unlike they may be in special features, there is, queerly enough, something ever designative about them. One rarely makes a mistake when, at first glance he exclaims—*Saxifragaceae!*

Providence, R. I.

THE HISTORY AND FUTURE OF FORESTRY IN THE UNITED STATES.

BY MARY F. HAGGERTY.

IN primeval times, ages before the discovery of the Western Hemisphere, there was but one forest on the American Continent, extending from sea to sea over one third of all the land. But during the glacial period when North America was covered with ice as far south as the latitude of Cincinnati, all the vegetation under and adjacent to this icy mantle was killed, and though growth started again after the ice melted and disappeared and though the land was once more occupied by softwoods and hardwoods, the continent was no longer covered by a stretch of continuous woodland. There were now three main forests—the great eastern forest which embraced all the land east of the Mississippi, and in some places much west of it; the forest of the Rocky Mountain Region and the smaller mountain ranges of the great basin; and the Pacific Coast Forest all of which united in the northern part of the continent to form a subarctic forest belt.

In the eastern forest the trees grew up much the same as before, but in the other forests were many diffrent species, due no doubt to the changes in soil, in climate or in the nature of the trees. On the Pacific Coast eighty different species of coniferous trees were found while all the trees grew taller than the eastern species, had thicker crowns and trunks, and grew in belts along the slopes of the mountains, instead of in clusters in ravines along the mountain sides. All of these three forest areas formed what has been called the "Virgin Forest."

One of the most important factors in the life of a forest is the reproductive power of its trees, dependent primarily on the quantity of seeds which each tree produces. Though the quantity is the first consideration there are so many more significant ones, that a tree may bear numerous seeds, and yet never reproduce itself. Among these considerations are first, the quality of a seed for a part of every seed may be unsound, and sometimes the larger part as in the case of the tulip tree; second the difficulty of disseminating, particularly of heavy seeds as walnut, etc.; third, the carrying of seeds to surroundings detrimental to successful germination, for instance seeds requiring moist soil may lodge upon dry ground, etc.; fourth, the period before a tree can produce seed, as in the case of the white oak, which does not produce any until it is forty years old; and fifth, the time elapsing between seed years—trees bearing seeds only every three or four years according to species, habitat, etc.

After a successful start seedlings often perish in the flames of destructive fires, under the feet of grazing cattle or in the litter of the forest floor, which their tender roots are unable to penetrate in their effort to gain the fertile soil beneath. The infant tree, the result of a succssful seedling may decay for want of proper light, watei or soil, for the trees in a forest are engaged in a constant struggle—tree against tree—for these essentials and the tree that receives too little or too much of any of them is bound to suffer if not to die. Each tree, therefore, to gain these necessities in the proper proportions adapts the manner of its growth and the shape of its branches and leaves; and for this reason we never see two trees exactly alike. However, it is advantageous for each tree at first, that it may receive enough light, to effect by self pruning a ball straight shaft, so that by dropping the lower branches it may expend all its energy in the spreading of its head and trunk.

Even if a seedling does overcome the obstacles outlined in the preceding paragraph, and develops into a healthy tree with a broad straight trunk and full crown, the battle is not yet won for there are still many enemies to conquer. We may ask: What enemies has the forest? And the answer is the physical forces of nature, plants, animals and man. Nature, in the form of wind, snow, ice, floods, landslides and lightning uproots or breaks the trees leaving desirable places for fungi and bacteria—the most harmful of all plants. Animals, such as mice, gnaw the bark of young trees and kill them, birds eat great quantities of seed; insects devour many parts of the tree; and cattle trample upon seeds and pluck shoots. Man however, is the most formidable enemy of the forest for more damage is done every year by fire and lumberers than by any other cause. Practically every forest fire is the result of human carelessness.

Notwithstanding the number of enemies the forest has, and the losses thereby sustained, it remains one of the most valuable gifts bestowed upon mankind. One of its missions is the regulation of temperature. We find in large forested areas a total absence of the scorching winds so common on our treeless plains. That like large bodies of water, they lower the average temperature of summer and raise that of winter is more doubtful. They serve also as valuable windbreaks, game preserves, and recreation grounds, services not to be scorned.

Another function—perhaps the most important—is the regulation of the water supply, and the prevention of floods and torrents by the gradual feeding of springs and streams. Owing to the shade of the forest and the spongy covering of its floor, the water is hindered from evaporating or running off as rapidly as it would on a barren stretch of land and thus the forests aid in storing water which re-appears evenly and continuously to stock streams, etc. The forests are also the source of such products as wood alcohol, vanilla, turpentine, rosin; and of such industries, as cooperage, furniture making, musical instruments, vehicle manufacture, agricultural implements, car building, railroad ties, telephone poles, and house building and finishing. And as we think of the value of these forest industries—they being second only to agriculture in the United States, the question comes to our minds, can we afford to neglect the source of such necessity, comfort, luxury, and wealth? Let us seek our answer from our experience of the past.

We shall begin with our ancestors, the settlers of this continent, who were surrounded on all sides by the forest, and who, regarding it as a constant menace destroyed it at every turn. Much that they destroyed, however, was done in a perfectly legitimate way, for they did not dare to leave the forests standing about their farms and villages for fear of the danger of attacks from Indians and wild beasts. They also needed to make their homes, their articles of furniture and their implements; and required land for agriculture. We cannot cast any blame on our ancestors, for thus destroying the trees they regarded as dangerous, but we regret that the idea passed from generation to generation and that it carried with it as corallary the delusion that the supply was inexhastible. It is clear that it was the abuse of the first idea that brought us more quickly to the second, and to the stern realization that our forests are far from inexhaustible.

The settlers first began to cut timber in the eastern states, then along the great waterways, and in the center of the country and finally in the more northern of the southern states and in all these areas, only the largest and best trees were cut, no provisions being made to protect or reforest the land. At present we are taking from our forests about three and one-half times as much wood as is added by new growth, and two-thirds of all the timber cut is simply destroyed. On the average since 1870 forest fires have yearly cost $50,000,000 in timber and 50 lives. In this country we consume four times as much lumber per capita, as England and three times, as much as Germany. We produce about one-third as much timber as might be grown by careful management. At this rate, and considering the increasing amount of land taken for agriculture, the remaining supply in our forests can last only thirty years longer, when not only our exports must cease, but also we shall not even have enough for home consumption. Think what such a shortage would mean, and then ask yourself how it can be prevented. There is but one way—by forestry. The term forestry has a very indistinct meaning to the greater part of the American public. Many of the people think that it is something new on the continent because it has been treated systematically and scientifically only within the past few years. However, they are mistaken, for forestry in this country is not new, it is as old as our human life. It does not have to be introduced into the United States, but rather its methods must be reformed. In the beginning, let us have a clear understanding of what forestry is. "It is not the science or natural history of woodlands nor the science of preserving woodlands, nor the science of planting trees. It is a combination of these three arts;" it is the art of managing and utilizing forests for the greater benefit of all the people concerned, both at present and in the future, and its only end is usefulness. Its principles are the same in every country and are based on natural laws, which are at work everywhere and at all times. Thus, the original part of the whole subject is largely the problem of how to apply these laws to fit the local needs. We turned to it about a score of years ago and have made great progress, thanks to the lessons which we have drawn from the experience of European countries.

All countries no matter what their differences in size, climate, population, or industries, have turned to forestry at some period of their development, and it is a curious fact, that with but one exception—England the more advanced nations have arrived first at the necessity of its use and proceeded farther in its science. It is practiced with beneficial results in all the countries of the world except China. Until recently our own country ranked nearly with China in this respect, and it still lags behind the progressive modern nations in all that relates to the protection, preservation and conservative use of the forests.

Perhaps the scientific treatment of forestry has reached its highest development in Germany where the problem of increasing not only the forest output but also the profits has been solved. The timber lands of Germany are three times better in quality today than before forestry was introduced. In France, the foresters have begun to create the difficult art of controlling the floods of mountain currents, by planting trees. That they have not finished their work is proved by the disastrous floods of the past spring, which are said to have arisen from the deforested areas. They have also removed the danger of wandering sand dunes by fixing them in place, by means of huge forests of pine, thus creating a property worth millions. The advance of forestry, and the methods of forestry in the republic of Switzerland are well worth our attention and imitation, for they have developed a wonderful type of government forest policy and demonstrated, beyond contradiction, the great yield in wood and money that forestry may bring if applied steadily for a number of years. And so the strides which forestry has been taking abroad could be exemplified in all the European countries. In Australia, Italy, Norway, and Sweden, it is well established as part of the national government. Turkey, Greece, Spain and Portugal give attention to their forests, while England, though she devotes little time to the problems of forestry in her own country, has made great progress in Canada, the Cape of Good Hope and British India. Indeed, in the last country in a little over thirty years, she has created a service of wonderful merit and achievments. What lessons can we learn from the success forestry has attained abroad? Briefly these first, that forestry pays and pays best where expense is not spared; second, that since it takes so long to repair forest waste, immediate action is necessary. Third, that private initiative is not sufficient to prevent wastefulness, that the Government must interest itself in forestry and forestry reforms, and fourth, that the prospects for forestry in the United States are remarkably bright. We know success may be attained, because we have no ancient forest rights or property questions to settle, because we have the experience—bitter in some cases—of other countries to guide us and because our forests have no equal in variety and value in the world. Are we then going to neglect these golden opportunities or have we begun to take advantage of them?

[TO BE CONCLUDED.]

DAME'S VIOLET.—Those who are familiar with the handsome cruciferous plant known as dame's violet (*Hesperis*) may have wondered how a plant so very cress-like in appearance could ever have been called a violet. The origin of this common name lies very far back in the history of plants. It was given to the plant at a time when flowers were not clearly distinguished and when they were all classed as roses, lilies, violets and the like. At the present day we are familiar with the fact that many plants popularly called lilies are not really so, and the same is true of roses. The word, violet once stood for a certain type of flower and the looseness with which it was applied is seen in such names as dog-tooth violet and dame's violet. The generic name, *Epilobium,* means violet on a pod and must have been given through some such ancient conception of a violet as we have indicated since it is not violet-like from a modern viewpoint. The color violet seems to have been named after the word violet had been restricted to the plants which now bear it. In the older view there is nothing incogruous in the term yellow violet.

NOTE AND COMMENT

WANTED.—Short notes of interest to the general botanist are always in demand for this department. Our readers are invited to make this the place of publication for their shorter botanical items. The magazine is issued as soon as possible after the 15th of February, May, August and November.

ROOT HAIRS.—Ordinary plants absorb water from the soil by means of their root-hairs—slender one-celled outgrowths from the region near the tip of the root. So nearly universal is this that many people are under the impression that all plants possess such structures. As a matter of fact most water plants lack root hairs and even some land plants such as some of the cone-bearers are without them. These latter are usually plants whose above-ground parts do not evaporate moisture rapidly. Many plants which normally produce root hairs, do not develop them if grown in water, but this is not true of all land plants and even some species that normally grow in water always bear root hairs.

FLOWERING OF WISTERIA.—There seems to be considerable difference in the flowering qualities of different Wisteria plants. Some produce an abundance of blooms while others treated equally well fail to respond with flowers. Mr. Elwyn Waller reports an old German gardener as saying that plants made from layers or suckers of this vine will not flower, but that flowering plants must come from seed, and asks for an opinion. It is, however, unlikely that any hard and fast rule can be laid down. In general the rules that apply to other plants would be applicable here. Any plant growing in rich soil is likely to be less fruitful than when growing in poorer ground. Moreover, a cutting taken from an old plant ought to bloom sooner than a similar plant from seed. The horticulturist sometimes hastens the fruiting of a young tree by grafting a twig from some older tree upon it. It would seem, then, that a layer from Wisteria should bloom sooner than a seedling, but that the position in which it grows has considerable effect.

Fertility of the Soil.—At first glance the fertility of the soil does not seem to lie in the province of the botanist, but the further investigation is pushed in this direction, the more does it appear to be entirely botanical notwithstanding all the fertilizers that the farmers still considers essential. There are certain chemical elements necessary to any fertile soil, to be sure, but given these no crops will grow without nitrates or nitrogen in some form and since nitrogen does not exist naturally in the soil, the supply must result from the action of bacteria. There is a large class of plants known as legumes, of which the pea and bean are examples, which have formed partnerships with certain bacteria able to fix atmospheric nitrogen, but the nitrogen used by other plants comes from the oxidation of ammonia and other organic compounds of nitrogen added to the soil. This oxidation is caused by bacteria, which, most people do not need to be told, are plants. But even these atoms have their enemies which must be overcome before they can do their best work. It has recently been discovered that there are immense numbers of one-celled, microscopic animals known as protozoa in the soil and these spend their time devouring the helpful bacteria. The problem is to make away with these harmful protozoa. Experiment has proven that this can be accomplished by baking the soil, pouring boiling water upon it, or even by treating it with chloroform or carbon disulphide. Most of the protozoa are killed by these processes and large numbers of the bacteria also, but the latter soon increase again and then number seven or eight times as many as at first. Thus is another practice of the cultivator placed on a foundation of scientific fact. It has long been known that soil may be rendered fertile by heating, but the reason has only just come to light.

Parasitic Plants.—According to Dr. D. T. McDougal, nearly twenty-five hundred species of parasitic seed-plants are known and if it were possible to discover all the species that are partial parasites feeding on the roots of other plants below ground it is certain that the total would be much larger. Among the changes that take place in a plant when it becomes even a partial parasite are a lack of differentiation of the tissues even in the seed and embryo, a lessened development of the shoot and root, a reduction of the leaf surface and diminished production of chlorophyll. If with the parasitic plants we include those which form partnerships with various fungi, and so are not entirely independent, the group would comprise about half of all the flowering plants in the world.

Fungi Named Free.—Most wanderers through the autumn woods constantly come upon strange forms of fungi clustered on decaying logs, projecting shelf-like from dead and decayed trees or springing from the old leaves on the forest floor. Most of these make good specimens by simply drying in some sheltered place and now that flowers are fast disappearing, form good subjects for further study. It is seldom that the novice in such studies can find a scientist willing to carefully identify even the commonest species, but such a fortuitous condition exists with reference to this group. All that is necessary is to collect several good specimens of each kind, dry them and after retaining a good specimen of each, send the rest to C. G. Lloyd, 309 West Court Street, Cincinnati. Give each specimen a number and Mr. Lloyd will report the name of each by return mail. Do not send toadstools; only woody fungi.

Abnormal Nelumbo Stamen.—We have received from Mr. Wm. Bembower, an abnormal stamen of the yellow lotus (*Nelumbo lutea*) which he found while examining some flowers of this species recently. In this, the anther, instead of being tipped with a curved projection as is usual ends in two rounded lobes. Whether this is an abortive attempt at a petal, or whether it is simply a slip in stamen making it would be hard to say. In the closely allied white water lily and yellow pond lily transition forms of stamens are numerous and it is likely that the specimen under discussion has a similar history. In the breeding of double flowers by the gardner, some slight abnormality of this kind is selected and by careful handling may produce the desired form.

The Caltrop in Illinois.—During the first week in September the editor found several specimens of the caltrop (*Tribulus terrestris*) on a railway embankment that borders the Desplaines river at Joliet. This appears to be a very rare plant in America. It is a native of the Old World and only during the last half century has it been known in this country. It was first found on ballast ground near the sea-coast, and later appeared in Nebraska, whither it had evidently been carried in some immigrant's baggage. A few years ago it was reported from Illinois, probably at Chicago, though the exact station does not seem to be known. The Joliet locality is the third inland station thus far known for the plant. Although it is to be regarded as a mere weed, considerable interest attaches to the plant from the form of its fruits. Each section of the five-parted fruit ends in two spreading points, and when one of the segments fails to develop, as is frequently the case, the resemblance to a maltese cross is very striking. Those who named the plant, however, were impressed by its resemblance to other and less pleasant objects. Its common name of caltrop refers to those ingenious implements of warfare of the same name, said to have been invented by the Romans, which were so arranged that no matter how thrown on the ground one or more spikes projected upward to bother pursuing horsemen when an army was in retreat. The Latin name for this implement was *tribulus* which suggests some of the tribulation it must have caused and has appropriately been taken as the name of the genus. A further and better illustration of the use of the name, tribulus, is found in the specific name for the sand bur (*Cenchrus tribuloides*). The well-known fruit of this species is a miniature *tribulus* and to this day bothers the barefoot boy much more than the contrivance for which it was named ever could have troubled the tribes which warred on Rome.

Double Sunflowers.—Two separate and distinct ideas are embodied in our conception of double flowers. In the commoner instance a double flower contains more than the usual number of petals due either to the transformation of stamens or of some other part, or to the splitting of the initial mass of cells designed to become a petal. It would, however, be just as rational to call a flower with more than the usual number of stamens a double flower, the point is that some organ of the flower has been multiplied. This however, is not true of the second phase of what we call doubling and which is well illustrated by double daisies, double sunflowers and the like. Here no additional parts are found. Such doubling consists simply in a more luxuriant development of some of the corollas in the flower head. The flowers mentioned all have ligulate corollas in the outer circles and our doubling is simply due to the fact that more of the regular corollas have become irregular and ligulate. If this is really doubling, the dandelion is one of the best naturally double "flowers" we have. The cause of the increase and change in the corollas of composite flowers is not easy to discover. The parent of the well-known garden plant "golden glow" grows along thousands of miles of streams and in countless swamps, and shows little tendency to vary. Suddenly, however, one plant sported and an appreciative cultivator spied it and the garden plant was the result. Double flowers in this sense are found in nearly all the cultivated composites. The tendency to "double" seems to be very strong in the wild sunflowers. After a year or so of cultivation one begins to find many half double and double specimens. In the editor's garden a number of these forms have occurred the past season and we look forward to another summer with some curiosity as to what may be expected from them.

Birds and Berries.—If asked to name the shrub upon whose berries the greatest number of birds feed, one would scarcely think of mentioning the elder (*Sambucus*) and yet, according to the last year book of the Department of Agriculture, no less than sixty-seven different species of birds are known to eat the fruits of this plant. Raspberries come next with 60 species of bird visitors and then come mulberries, dogwoods, sumachs, wild cherries and blueberries. That such fruits should form the principal diet of frugiverous birds is not surprising but we who have tasted many of the other fruits listed on the birds' bill of fare can be sure that the opinions of man and bird as to what is palatable do not coincide for we find among other fruits eaten china berries (*Melia*), buckthorn (*Rhamus*), Manzanita (*Arctostaphylos*), Christmas berry (*Heteromeles*), pepper tree (*Schinus*), snow berry (*Symphoricarpos*), sour gum (*Nyssa*), holly (*Ilex*), spicebush (*Benzoin*), juniper (*Juniperus*), Virginia creeper (*Ampelopsis*) and pokeberries (*Phytolacca*). This information is brought out in an article on plants useful to attract the birds. There are lists of the most desirable plants for this purpose for different parts of the country. Those who have extensive grounds and wish to attract the birds should be able, by proper selection of shrubs and trees to be surrounded by birds without lessening in any way the appearance of the decorative planting.

LEGUMES.—The words legume and leguminosae have very definite meanings in our day, but at the time that the present meanings were crystallizing about the words it might have been quite proper to call an apple or a gooseberry a legume. The word is from the Latin *legere* meaning to gather and was long ago applied to various cultivated plants whose fruit was gathered, to distinguish them from those others which were cut down and the desired parts beaten out. Wheat and barley were of course not legumes, because the fruits were not gathered by hand, but beans, peas, lupines and the like, which were taken from the plants in the field, were known by this term. It is doubtless due to the fact that plants with pods predominated in the gathered crops, that the word legume has at last come to stand only for plants bearing pods, and to give the name to one of the most useful and handsome of plant families.

CONTENTS OF SEEDS.—A seed is sometimes defined as a young plant enclosed in a hard outer covering often with more or less albumen or food. For most plants this definition would hold good. In the common bean, for example, we find at maturity a slender axis, which is destined to be the beginning stem, to which are attached one or more cotyledons and other rudimentary leaves. But this is not always the case. In some plants, such as many Ranunculaceae, when the seeds are ripe, that is, when they are ready to fall from the plant, the plantlet that should be within is represented merely by a mass of undifferentiated cells, and in other plants there are all gradations of this up to complete embryos. In those seeds in which the embryo is not well developed, when the seed is ripe, the young plantlet continues to develop while the seed is dormant. One of the extreme cases is found in the maidenhair tree or ginkgo where the fertilization necessary to begin the embryo plant does not take place until the seed has fallen from the parent tree. It is well-known that many seeds will not grow as soon as they are "ripe," and the facts noted above no doubt account for it.

A CHANGEABLE PHLOX.—The editor has had growing in his grounds, the past summer, a specimen of phlox possessing the peculiarity of changing color according to the hour of the day. In the early morning and at sunset, it is bluish purple and at mid-day it is a decided pink. This is a real color change and not due to the amount of light. There are many species of flowers known that change color as the age of the bloom changes, such as the white trillium which turns rose colored as it begins to wane, but flowers are rare that change back to the original color again after the first change is made. The behavior of the phlox mentioned is such as to suggest the action of litmus paper when transferred from an acid to an alkaline medium. Possibly the changes in the flowers may be explained in much the same way. Many plants with pink buds open blue flowers due to the fact that the sap of the buds is acid and that of the flowers is alkaline. It is likely that the activities of our phlox may change the nature of the sap in some way from hour to hour and thus cause the change in color.

JAPANESE AIR PLANT.—During the winter one may often find in the florist's shops certain bright green feathery sprays that are very fern-like or moss-like in appearance and go by the name of Japansese air plants or air ferns. Investigation shows, however, that instead of being either ferns or mosses, they do not even belong to the plant kingdom. They are really colonies of sertularian hydroids—small sea animals allied to the corals and jelly fishes—which, like the corals, build up a common structure to which the individual members are attached. There are a great many different species of these hydroids in the shallow places near the seashore and they are often washed up by the waves and gathered as sea weeds by the uninitiated. It has sometimes been reported that the Japanese air plant is a sea-weed of the genus *Demarestia*, but it is certain that the bulk, if not all, of the specimens offered for sale are not sea-weeds. Possibly a variety of sea products are used in this way. The specimens are dried and then dyed a bright green, and of course do not grow, though many people will be found to assert that they do. We are indebted to Dr. E. F. Bigelow, for the identity of the specimens.

Chemicals Excreted by Plants.—Since plants cannot select the minerals composing the soils in which they grow, it must often happen that there enters the plant along with more useful substances, a number of useless or even harmful minerals. Or it may be that the plant, in forming some necessary product, will have left over as a by-product, more or less chemical matters that must be disposed of. These are taken care of in various ways. Sometimes they are formed into crystals and stowed away in the cells of the leaf, or they may be isolated in the bark, the wood or in the latex of the plant. Some few plants have the faculty of excreting some of these substances which may be found as incrustations on the surface of the leaves. Various species of the sword fern (*Nephrolepis*) excrete lime at the tips of the veins, and A. B. Klugh reports in *Rhodora* the excretion of salt by a salt meadow grass—*Spartina glabra alterniflora.* Whether such excretions are of benefit to the plants is still a question. Some botanists are of the opinion that they may aid the plant in securing water from the air under certain conditions.

SCHOOL BOTANY

Practical Botany.—The matter of botanical instruction in all schools is to a large extent a matter of fashion, and the fashion is usually set by the larger universities where no attempt is made to give botany an industrial trend. There has been developed a splendid lot of texts on morphology, embryology, systematic botany, physiology, etc., but none of this material has been presented in its agricultural bearing, and consequently the field of botany in agriculture has not been clear. At the present time it has neither direction nor agressiveness. What we really need to work on is the science of the breeder's art and the science of the gardener's art. At present the art is far in advance of the science. In fields where the agriculture art was not highly developed—notably pathology and bacteriology—the botanist has accomplished great things. If we pursue agriculture or any phase of it without devoting our science to it we can become at most expert farmers. By devoting our science to agriculture and having faith in its potency no man can fortell the outcome.—*C. V. Piper in Science.*

Storing Facts.—Go to the nearest printer or paper dealer and get a supply of manilla slips cut somewhat smaller than a postal card. Place these where they wil be readily accessible when you are reading and when you chance upon a fact that may later be useful to you jot it down then and there. Give the note a title on the top line that shall indicate its contents, add at the bottom the title and page of the volume or magazine from which it was taken and file away for future reference. When any subject comes up, upon which you want the latest facts run through your notes and you have them. Cards are better than a note-book for the reason that they can be sorted out into subjects at five minutes notice. Those who desire a more elaborate system can get ruled index cards at the nearest book store, but the manilla cards are quite good enough. No teacher is so well informed that he can afford to stop acquiring information about his special subjects, nor can he depend upon his memory to retain everything of value he reads.

HIGH SCHOOL TEXT-BOOKS.—A second evidence of our confidence in systems is found in the easy insouciance with which university professors proceed to write text-books for high schools. The only qualification the most of them have therefor is a knowledge of their subject, and they seem to regard any personal acquaintance with the peculiarities of young people and with the special conditions of high school work as comparatively negligible. In consequence, these books are necessarily addressed to some kind of idealized student, usually a bright-eyed individual thirsting for knowledge. This kind does exist but in minority, whereas the real student with which the high school must deal is one of a great mass willing to learn if it must. Confirmation of the correctness of my view that knowledge of students is as important as knowledge of the subject for the writing of a high school book is found in the fact that the author of the botanical text-books, most widely used in the high schools of this country has had only a high school experience. Another phase of our belief in the sufficiency of systems is found in the utterly impracticable character of many of our books. These recommendations have obviously been worked out in the comfort of the study chair and have never been actually tested in use by their suggestors;

yet they are presented in a way to make the student feel that he is either negligent or stupid if he fails to work them. These theoretically constructed schemes for elementary teaching and these recommendations of untried and impracticable tasks for students sometimes run riot in company with sweeping denunciations of our present laboratory courses and suggestions for their replacement by hypothetical field courses utterly regardless of the fact that the former, whatever their faults, have been evolved in actual administrative adaptation to the real conditions of elementary work while the proposed substitutes are wholly untried and in the light of existing conditions wholly impracticable.—*Prof. W. F. Ganong, in Science.*

KEY TO THE POLYPETALOUS DICOTYLEDONES.*

1 Shrubs, trees or woody vines. (2).	
2 Stamens more than twice the number of petals (3).	
3 Leaves opposite (4).	
4 Stamens on the receptacle	Hypericaceae. (G. 571. B. 624)
4 Stamens on the calyx	
Ovaries several, distinct, enclosed	Calycanthaceae. (G. 409. B. 435)
Ovaries compound	
Free from the calyx	Lythraceae. (G. 591. B. 648)
Adherent to the calyx	Saxifragaceae. (G. 444. B. 484)
3 Leaves alternate. (5).	
5 Stamens on the calyx tube	
Fleshy plants	Cactaceae. (G. 588. B. 643)
Plants not fleshy	Rosaceae. (G. 454. B. 490)
5 Stamens on the receptacle (6)	
6 Petals convolute in bud	Malvaceae. (G. 566. B. 617)
6 Petals imbricate or valvate in bud (7)	
7 Ovaries compound	
Sepals valvate; flowers small	Tiliaceae. (G. 565. B. 616)
Sepals imbricate; flowers large	Ternstromiaceae. (G. 570. B. 523)
7 Ovary or ovaries distinct and simple	
Petals six, valvate in bud	Anonaceae. (G. 410. B. 410)
Petals, three to nine, imbricate	
Climbing vines	Menispermaceae. (G. 410. B. 434)
Trees or shrubs	
Leaves simple	Magnoliaceae. (G. 408. B. 409)
Leaves pinnate	Mimosaceae. (G. 500. B. 527)

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*The numbers in parenthesis refer to the pages in Gray's and Britton's Manuals respectively. For keys to other groups, see earlier issues.

tamens not more than twice the number of petals (8)	
8 Carpels one or more, distinct	
Carpels 2 to 6	
Climbing vine	Menispermaceae. (G. 410. B. 434)
Tree; leaves pinnate	Simarubaceae. (G. 538. B. 582)
Carpels one	
Flowers six parted	Berberidaceae. (G. 411. B, 432)
Flower five parted	Leguminosae. (G. 500. B. 528)
8 Carpels united. (9)	
9 Adherent to the calyx (10)	
10 Flowers four-parted	
Stamens eight	Onagraceae. (G. 594. B. 651)
Stamens four	Cornaceae. (G. 623. B. 689)
10 Flower five-parted	
Carpels five, styles five	Araliaceae. (G. 605. B. 667)
Carpels two	
Leaves palmately veined	Grossulariaceae. (G. 444. B. 486)
Leaves pinnately veined	Saxifragaceae. (G. 444. B. 484)
9 Ovary free from the calyx or nearly so (11)	
11 Stamens opposite the petals and of same number	
Leaves opposite. Plants with tendrils	Vitaceae. (G. 562. B. 613)
Leaves alternate. No tendrils	Rhamnaceae. (G. 560. B. 611)
11 Stamens alternate with petals or different in number (12)	
12 Leaves opposite (13)	
13 Carpels one or two	
Style one	Oleaceae. (G. 650. B. 723)
Styles two	Aceraceae. (G. 557. B. 607)
13 Carpels three to five	
Leaves simple	Celastraceae. (G. 556. B. 605)
Leaves pinnate	
Fruit not inflated	Sapindaceae. (G. 559. B. 609)
Fruit inflated	Staphyleaceae. (G. 557. B. 606)
12 Leaves alternate (14)	
14 Compound	
Ovary one-seeded	Anacardiaceae. (G. 552. B. 599)
Ovary more than one-seeded	
Ovary three-seeded	Sapindaceae. (G. 559. B. 609)
Ovary two-seeded	Rutaceae. (G. 537. B. 581)
14 Simple (15)	
15 Fruit drupe-like	
One-seeded	Anacardiaceae. (G. 552. B. 599)
Four to six-seeded	Aquifoliaceae. (G. 554. B. 602)
15 Fruit dry	
Seeds with an aril	Celastraceae. (G. 556. B. 605)
Seeds not arilled	
Ovary two-celled, two seeded	Hamamelidaceae. (G. 452. B. 488)
Ovary three-celled, many seeds	Ericaceae. (G. 626. B. 692)

1 Herbaceous plants (16)	
16 Leaves opposite (17)	
17 Stamens more than twice the number of petals	
Pistils many, distinct, simple	Ranunculaceae. (G. 392. B. 411)
Pistils three to five somewhat united	Hypericaceae. (G. 570. B. 624)
17 Stamens not more than twice the number of petals (18)	
18 Pistils one or several separate, simple	
Pistils one, petals six to nine	Berberidaceae. (G. 411. B. 432)
Pistils more than one	
Pistils two; juice milky	Asclepiadaceae. (G. 663. B. 740)
Pistils three or more	Crassulaceae. (G. 441. B. 473)
18 Pistils united (19)	
19 Ovary adherent to the calyx (20)	
20 Carpels as many as sepals	
Anthers opening down the side	Onagraceae. (G. 594. B. 651)
Anthers opening at apex	Melastomaceae. (G. 593. B. 650)
20 Carpels fewer than sepals	
Ovary many seeded; styles two	Saxifragaceae. (G. 444. B. 484)
Ovary one-seeded	
Styles two or three	Araliaceae. (G. 605. B. 667)
Style one	Cornaceae. (G. 623. B. 689)
19 Ovary free from the calyx (21)	
21 Stamens as many as petals and opposite them	
Style and stigma, one	Primulaceae. (G. 643. B. 713)
Style one; stigma three-cleft	Portulacaceae. (G. 387. B. 384)
21 Stamens alternate or of different number from petals (22)	
22 Leaves toothed or lobed	
Flowers four-parted; stamens six	Cruciferae. (G. 418. B. 443)
Flowers five-parted; stamens ten	Geraniaceae. (G. 534. B. 572)
22 Leaves entire	
Petals and stamens on the calyx	Lythraceae. (G. 591. B. 648)
Petals and stamens on the receptacle	
Flowers irregular	Polygalaceae. (G. 538. B. 582)
Flowers regular	
Two or three-parted	Elatinaceae. (G. 575. B. 629)
Five-parted	
Leaves dotted	Hypericaceae. (G. 392. B. 411)
Leaves without dots	Caryophyllaceae. (G. 377. B. 387)
16 Leaves alternate or plants acaulescent (23)	
23 Stamens more than twice the number of petals (24)	
24 Stamens on the receptacle (25)	
25 Carpels several, distinct or united at base only	
Leaves not peltate	Ranunculaceae. (G. 392. B. 411)
Some or all of the leaves peltate	Nymphaceae. (G. 389. B. 406)
25 Carpls united (26)	
26 Petals numerous, sepals four to six	Nymphaceae. (G. 389. B. 406)
26 Petals four to eight (27)	
27 Petals five only	
Convolute in bud; sepals five unequal	Cistaceae. (G. 576. B. 630)
Imbricate in bud	
Sepals five, leaves tubular	Sarraceniaceae. (G. 439. B. 469)
Sepals two	Portulacaceae. (G. 387. B. 384)

27 Petals four, six or eight
Flowers borne singly — Papaveraceae. (G. 414. B. 437)
Flowers in racemes and spikes — Resedaceae. (G. 439. B. 469)

24 Stamens not on the receptacle
On the corolla, stamens forming a tube — Malvaceae. (G. 566. B. 617)
On the calyx
Sepals two — Portulacaceae. (G. 387. B. 384)
Sepals three to five
Petals imbricated; fruit simple — Rosaceae. (G. 454. B. 490)
Petals convolute; fruit compressed — Loasaceae. (G. 588. B. 641)

23 Stamens not more than twice the number of petals (28)
28 Ovary adherent to the calyx (29)
29 Style one, carpels two to six — Onagraceae. (G. 594. B. 651)
29 Styles more than one
Styles two
Carpels two; seeds several — Saxifragaceae. (G. 444. B. 476)
Carpels two, seeds two — Umbelliferae. (G. 607. B. 669)

Styles three to five or more.
Ovary one-celled, sepals two — Portulacaceae. (G. 387. B. 384)
Ovary three to five celled. Sepals five. Araliaceae. (G. 605. B. 667)

28 Ovary free from the calyx (30)
30 Pistils simple, distinct
Five or more
Stamens once or twice the number of petals
Crassulaceae. (G. 441. B. 473)
Stamens more numerous — Ranunculaceae. (G. 392. B. 411)
Pistils one only.
Stamens united into a tube — Leguminosae. (G. 500. B. 532)
Stamens not united
Stamens five — Violaceae. (G. 579. B. 633)
Stamens more than five
Once or twice the number of petals
Berberidaceae. (G. 411. B. 432)
More numerous — Ranunculaceae. (G. 392. B. 411)

30 Pistil compound
Four or five-celled
Juice sour — Oxalidaceae. (G. 532. B. 575)
Juice not sour — Linaceae. (G. 532. B. 578)

Less than four-celled.
Two-celled.
Stamens six, tetradynamous — Cruciferae. (G. 418. B. 443)
Stamens four to eight, equal. Polygalaceae (G. 538. B. 582)

One-celled. ...
Stamens four to thirty-two, separate.
Capparadaceae. (G. 438. B. 467)
Stamens six or less.
Stamens six, diadelphous — Fumariaceae. G. 416. B. 437)
Stamens five; styles 3 to 5 — Droseraceae. (G. 440. B. 470)

EDITORIAL

It seems about time that botanists in general were again stirred up regarding contributing to this magazine. It is surprising what a lot of good people there are who think that the only article worth reading is some extended affair that takes up half the pages of the publication. They estimate the worth of an article strictly according to its length, but it would be just as logical to value our friends in the same way. We have no objection to longer articles when they bear upon subjects in which we are interested, but at this time we wish to make a plea for the less extended items. Some time ago, we endeavored to ascertain the views of our readers in regard to the most desirable kind of article to print, and the replies were overwhelmingly in favor of the short notes. Not a few people, however, seem to have a vague idea that such notes are somehow beneath their dignity, but this idea may be dismissed. There is doubtless not a reader of this magazine who, in the course of a single summer, does not see many things worthy of record. Anything about plants that is of enough interest to mention to your friends would certainly interest a larger audience. We are well aware that the field occupied by this magazine is a peculiar one, and that students of the topics it treats of are none too abundant, but this phase of botany is most vigorous at present and bids fair to be very prominent in future, and we hope to bring out more observations along these lines. To thoroughly enjoy economic and ecological botany requires a considerable knowledge of plants in the field and as a result our readers are all thoughtful, well-informed people—a class from which we ought to expect a large number of such observations as we have indicated. Now that the long evenings indoors are at hand, we hope to find a large increase in such communications.

BOOKS AND WRITERS.

Upwards of a hundred mushrooms, puffballs and the like are treated in the "Guide to Mushrooms" by Emma L. Taylor Cole, published by Doubleday, Page & Co. As a collection of careful descriptions of mushroom species, the book has much in it to recommend, but as a guide for the inexperienced we fear the book is likely to be a flat failure. There is no key of any kind, and though the species treated are the more familiar kinds, there are so many others that resemble them that the beginner is never likely to feel certain and if he does, a fairly long list of deadly poisonous species lie in wait for the over confident. We advise beginners not to place too much dependence upon this guide. The book, however, is a handy little volume easily carried into the field. It is illustrated with four colored plates and many photographs, scarcely a page of text being without its illustration. In addition to accurate descriptions, the edible or poisonous qualities are discussed and the habitats of the plants given. Notes are also included on collecting and cooking the various species. The price of the book is $1.00 *net.*

We have heard a good deal in recent years, about popular handbooks of the wildflowers but most of them have turned out to be pre-digested scientific treatises designed for the popular taste. Now at last comes a really popular book—one that is written from the public's view-point, at least—though whether it will be any more popular than the others remains to be seen. In "Wildflowers East of the Rockies" by Chester A. Reed we have a volume that does not even pretend to describe the plants in scientific jargon. The descriptions are such as we might expect from the farmer or man of affairs who having found a strange plant mentions its noticeable features in order to have it named. And these descriptions really describe, mentioning a hundred and one characteristics of the plants that the strict botanist never indicates if indeed he knows them. Even the older student of plants may find much of interest in a perusal of its pages though familiar with the flowers it describes. The plants are arranged in the most modern sequence and the great majority are illustrated. The illustrations, however, are distinctly inferior to the text. For the most part they are correct as to outline but very faultily colored. Doubtless they are near enough to the likeness of the plants to aid in identification. There is but one key and this is based on color, and not very accurate withal. As the plants are not arranged according to color the beginner may find some difficulty in using it. It will do him no harm, however, to read the book straight through. There are more than 400 16-mo. pages in the volume which is priced at $2.50 *net*. It is issued by Doubleday Page & Co., New York.

Among the Russell Sage Foundation publications issued by the Charities Publication Committee of New York is a recent volume by Dr. M. Louise Greene entitled "Among School Gardens" that will interest all teachers who have garden making included in their list of subjects to be considered. It not only discusses school gardens in general, but gives directions for garden making that ought to be of service to the novice in this kind of work. A most stimulating part of the book is the account of what has been accomplished in school garden work throughout the United States and Canada. It is an encouraging sign of the return to sanity in educational matters that the attention of the children is being directed to the world we live in and some familiarity with animals and plants substituted for the overload of foreign languages under which most high school pupils are still staggering. The book abounds in illustrations of actual gardens and their happy owners and thus adds another inspiration to continue the good work. The book is sent postpaid for $1.25.

Grace Tabor and Gardnes Teall say in the preface to their interesting little "Garden Primer" that it is designed to set forth in the most direct form, but without technicalities the fundamental principles of amateur gardening in America." A look at the book shows that they have done even more; for they have set forth the facts in most charming form and made a book that will interest anyone beginning to garden. So far as we have discerned nothing of importance has been omitted that the gardener needs to know. A chapter is devoted to each phrase of the subject and there are planting tables, spraying tables and a gardener's kalendar wherein one finds hints regarding the work necessary each month. The book is illustrated by photographs and is published by McBride, Winston & Co., at $1.00.

What Prof. L. H. Bailey has to say regarding matters horticultural is always of interest to a wide circle of readers both amateur and professional. For years "Garden Making" and the "Practical Garden Book" have served as standards for tillers of the soil, and now we have "A Manual of Gardening" which seems to be a combination of the two earlier works designed "as a practical guide to the making of home grounds and the growing of flowers, fruits and vegetables for home use." The book has a certain familiar appearance about it due to the use of illustrations from the other books, and to a similarity of treatment in the text. As would be expected the author advocates the "natural" manner of planting the home grounds, and believes in the use of our own wild plants for decorations, though attention is also given to carpet bedding and other formal planting. The latter half of the book is devoted to useful information regarding the growing of the plants in lawn garden and the house. The sensible and refreshing way in which the author discusses each subject makes the reading attractive while the information conveyed is that which every up-to-date gardner must possess. The book contains more than 500 pages and costs $2.00 *net.* It is published by MacMillan's.

"Agriculture Through the Laboratory and School Garden" by Jackson and Daugherty is not a new book, having appeared first in 1905 but that it continues to be a popular text for school courses in agriculture is attested by the appearance of a second edition recently. The book is logical in expecting the student to find out things for himself and carefully worked out directions for experiment are scattered plentifully through the book while the text discusses the subject in general. Added to the matter of a purely agricultural nature is considerable material on milk and its care, farm animals, principles of feeding and the like. Following each chapter are references to other works bearing on the subjects. The book will be very useful to young teachers as it wastes no space in mere words. The experimental work will be most helpful. The book is published by the Orange Judd Company and costs $1.50.

THE CULTIVATION OF FUNGI.—In America the only attempt at cultivating edible fungi seems to have been directed toward growing the familiar mushroom. In the Old World, however, more attention is given to growing other species. According to *Scientific American* the black truffle (*Tuber melanosporum*) is successfully propogated by grinding up ripe specimens with water into a paste which is spread on green hazel or oak leaves and buried in the oak forests. Similar results attended the planting of the craterelle (*Craterellus nucleatus*). It would seem highly desirable that experiments be started in this country with a view to producing such fungi as the shaggy mane mushroom (*Coprinus comatus*) and various puff-balls, especially the giant puff-ball (*Calvatia gigantea*). The puff-balls keep well, are in good condition for a long time and afford a large amount of palatable food.

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TREE YUCCAS, MOJAVE DESERT

THE AMERICAN BOTANIST

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"I look along the dusty, dreary way,
So lately strewn with blossoms, fresh and gay,—
The sweet procession of the year is past,
And withered, whirling leaves run rattling fast
Like throngs of tatter'd beggars, following
Where late went by the pageant of a king."

—*Kemble.*

SOME TREES OF THE CALIFORNIA DESERTS.

BY CHARLES FRANCIS SAUNDERS.

ONE of the paradoxes of life in Southern California is the fact that the finest firewood is obtained from the desert. This is mesquite, a superlatively good wood, the sticks often a foot or more in diameter—solid, honest fuel through and through, slow burning like lump coal and leaving very little ash. That it retails in Pasadena at $15 to $17 per cord is unimpeachable evidence of its worth.

Few facts strike the visitor to the western rim of our continent more forcibly than this fact that the desert produces anything of worth, and especially that trees grow upon it. Yet the tree lover finds very interesting material awaiting him on these arid stretches, which in California, are known as the Mojave and the Colorado Deserts. The latter, so-called because the Colorado River skirts its eastern border, is the principal home of the mesquite within the state. This is a low, widely branching tree, sometimes half buried in drifting dunes, so that only the upper limbs and feathery foliage are visible. At times two or three old trees are found growing so near one another that their branches intermingle and as these are armed with formidable thorns the result is a thicket as dangerous to flesh and clothing as a cactus jungle.

The family relationship of the mesquite is with the peas and beans, a fact less evident from the rather inconspicuous greenish-yellow flowers that appear in spring than from the bean-like seed pods with which the little trees are later abundantly adorned. These pods contain a sweetish-sourish pulp when mature, but to the desert dweller their chief value is when they are dried. They then make a valuable fodder for horses and cattle, while the seeds themselves if ground make a nutritive meal for human food, as the older generation of Indians well knew.

Of the same family but very different in appearance is the small tree *Dalea spinosa.* With thorny, almost leafless branches, it is likely to be passed by the traveler as dead or dying, unless the time be early summer, when it presents a sight he is not likely to forget. It is then covered with myriads of purple pea-like blossoms all the more remarkable because of the hot, parched waste in which the tree grows. I seem to remember having seen this desert denizen listed in some nurseryman's catalogue, and it may be that it has been introduced into cultivation. It is certainly worthy of a place in any garden, though how it would grow under other conditions than those of its desert home, I do not know. Plants accustomed to the excessive dryness of the desert air will often start well in moister surroundings but are very subject to the attacks of scale and other insect pests.

Other trees of this desert of southeastern California are the so-called desert willow (*Chilopsis saligna*) with a willow-like aspect and whitish mottled flowers like catalpa to which it is of kin, and the palo verde (*Parkinsonia Torreyana*). The latter, as the Spanish words of its name indicate, is indeed a green tree—green from base of trunk to tip of the highest branch. Yet its leafage is inconspicuous, the verdant aspect being due to the greenness of the smooth bark which covers both trunk and limbs.

The above mentioned trees grow very scatteringly about the desert, the individuals as a rule far separated from one another. There are, however, at least two other kinds of a more gregarious habit, forming groves of greater or less extent. The more important of these is the stately California fan palm, of the botanical genus *Washingtonia* named in honor of our country's first and most eminent president. It is widely cultivated both in southern Europe and in California where avenues are often lined with it and its "fronded heads" make a large element in the semi-tropic appearance of our Land of Sunshine. In the desert it is found in groves about alkaline springs, and is most abundant in or near the mouths of certain canons of the San Jacinto mountain along the desert's western edge. I have seen it there close to one hundred feet high, the green fan-like leaves clustered at the summit of the slender trunks, which are draped with the reflexed old leaves, hanging head downward and forming a protecting thatch or apron.

Much less beautiful but quite as striking is appearance is the grotesque Joshua tree, an arborescent yucca of the Majave Desert. The Santa Fe Railroad's California line passes through a scattered "forest" of these strange growths just east of the San Bernardino Sierra which separates the cast country from the desert. With shaggy, clumsy trunks, contorted limbs and branches terminating in bunches of stilletto-like leaves bristling in all directions, they seem like trees of a nightmare. The best attain a height of fifteen or twenty feet and in their uncounth way are not unsymmetrical; but generally the branches develop irregularly and present many fantastic shapes, such as tridents, rude crosses, columnar clubs, or writhing, upraised arms with clenched fists.

The term Joshua tree as applied to this singular yucca, dates, I believe, from the time of the Mormon occupation of the Great Basin, but I have never been able to ascertain the reason for it. Perhaps some reader of the *American Botanist* can throw light on the question. I have always heard it spoken of by the California desert people as "cactus," but it is truly a yucca. To find a use for the trees, which are very abundant on the Mojave Desert, has long taxed the ingenuity of the inventive. An Englishman who thought he had solved the problem, once shipped a cargo of the trunks to England and had it made up into paper pulp, and I have read that an edition of a certain British journal was printed on the paper so made. It was not a satisfactory article,, however, and the venture was not repeated. At present there is a factory in Los Angeles which uses considerable of this yucca wood for the manufacture of such articles as surgeons' splints, book covers, scrolls for wrapping the trunks of young nursery stock, etc.

Pasadena, Calif.

ECCENTRICITIES OF DISTRIBUTION.

By Dr. W. W. Bailey.

IF, as often happens during the midsummer days, some one brings me for determination a specimen of "woad wax," the broom (*Genista tinctoria*), it is my habit to inquire "when were you in Salem, Mass.," or I may extend the inquiry to any part of Essex County. This very pretty legume yellows that whole region as the gorse does certain portions of Great Britain. It has prevailed there very many years. But the question is, why *there* only? Why, in these days of rapid transit is it not carried far and wide. As a matter of fact it is not. I have seen stray specimens of it in Little Compton, R. I. and I think once in South Kingston, but why doesn't it come down in full platoon front to Attleboro, Mansfield and Pawtucket?

Again, throughout Greater Boston, say in Cambridge, Jamaica Plain, Roxbury and Dorchester, the morning hours of summer are made gay with the splendid blue heads of chickory. It is characteristic of the region. Yet forty miles away, in Rhode Island, this vigorous plant is very local and when found is rarely in any quantity.

Echium vulgare, as far back as my early botanizing, prevailed as it still does, in vast abundance about the Fall River railroad tracks and the Wilkesbarre coal wharfs in East Providence. In any other part of Rhode Island and adjacent Massachusetts, it is rare. Yet, so far as we can see, there is no reason why it should not spread along the railway at least to Riverside. All we know is that it doesn't. A furtive plant may now and then be seen there, and once I found a little patch of it, but this weed which is a curse, I am told, on Staten Island and elsewhere in the Middle States, is with the exception recorded above, a rarity.

The parsley family, Umbelliferae, shows some queer tricks of distribution. In all Rhode Island, even to Block Island the wild carrot or Queen Anne's lace is the prevailing weed, a lovely nuisance, everywhere. About Mt. Wachusett it is almost entirely replaced by caraway. Then if one extends his journey to Lebanon Springs, N. Y., he sees neither of these plants but in their place the common parsnip. Every place seems to call for an umbellifer in quantity, but each place as a rule exhibits a different one. There is something curious in these facts if philosophy could find them out. Somewhat similar facts are shown with the mints, Labiatae. In one place, as on Mt. Wachusetts catnip almost solely prevails; in another it is replaced by motherwort. Both are foreign importations.

These matters have long been in my mind but as yet I can offer no explanation of the phenomena.

Providence, R. I.

THE HISTORY AND FUTURE OF FORESTRY IN THE UNITED STATES.

By Mary F. Haggerty.

(CONCLUDED)

The first Government action, which bears any relation to forestry was taken in 1799, when Congress appropriated $200,000.00 for the purchase and preservation of timber lands to supply ship timber for the Navy. In 1822 it authorized the President to employ the Army and Navy to protect and preserve the live oak, and red cedar of the government in Florida. In 1872, Yellowstone National Park was established and in 1873 Congress passed its Timber Culture Act which gave government land in treeless regions to whomsoever would plant one fourth of his claim with trees. The knowledge that the forests were being destroyed very rapidly, and the work of the different forest associations, which were being formed at this time, led to the passing of the first real forest bill in 1891, which repealed the Timber Culture Act, and authorized the President to reserve timber lands on the public domain. In the beginning this act was met by much just opposition, for though Congress had set apart the lands and their resources, it had made no provision for their use or protection. However, this mistake was remedied in 1897, when a law was passed making it possible to use all the lands and give them suitable protection, and it was this act which created the national forests, or forest reserves. Since 1900 these forests have been carefully surveyed and mapped, and additions are made to them yearly. The increase in 1908 being 17,142,941 acres and that in 1909 26,528,439 acres. The national forests of today consists of about 145,000,000 acres in the United States and 26,500,000 more in Alaska and Porto Rico. Men well trained in the employ of the forest service will, if offered a better position financially, leave the government employ and work for individuals or corporations, and in this way, the government is the means of sending out to all parts of the country, men well trained in forestry.

Many people were and are greatly opposed to the national forests because they think they are injurious to the home seeker, to the miner, to the user of the range, to the user of water and to the tax-payer. Let us see if such is the case. Before a national forest is created, all agricultural land, as far as possible is excluded, but if there is any agricultural land so situated within the boundaries that it cannot be cut out, the homeseeker is at liberty to choose such of it as he wishes to apply for. Here, after the usual proceedings, he may spend the remainder of his life, providing he takes the land for a home only. The miner may stake out and develop claims just the same on the national forests as on the public domain, provided he does not take up claims merely for the timber on the land or for other purposes not connected with mining. The man who wishes timber for domestic use or for mining gets all he wishes for the asking, and the one who wishes it for commercial purposes may obtain it promptly and at a reasonable rate. There is no chance for a monopoly and the local demand is always supplied first. The government protects the range from being burnt, overcrowded and overgrazed, prevents disputes between owners of stock and sees that each owner gets the use of range to which he has the best right; the man having a few head of cattle gets his share of range as easily as the man with hundreds. The use of water is not affected in the least, because the appropriation of water is governed entirely by State and Territorial laws. The tax-payer, instead of being liable to heavier taxes is not so heavily burdened as if there were no forests in the country in which he lives, for they pay the county ten percent of all the receipts from sale of timber, etc., so that we are obliged to admit that instead of opposition, there should be hearty co-operation between these citizens and the managers of the national forests. Instead of being an abuse to them, the national forests are of great use.

But these are not the only people who are indebted to the Government for the creation and management of forest preserves. They are of great value to all the people. First, the management sees that though the wood is used, it is not used up. By wise use the timber is not only conserved but also a better quality of wood is secured by encouraging a new and better growth of all of the useful trees. Second, the forests, which are situated in regions of heavy rainfall are maintained chiefly to prevent the water from running off in destructive floods, and in the arid regions of the Rockies, to make the best use of every drop of water. They also keep the range in excellent condition by barring out wild animals which would damage the range and by giving to each man his just share. Third, perhaps the greatest service of the national forests is the good use to which all the land is put by preventing monopoly by corporations—the dangers of which need not be discussed; by preventing or causing a decrease in fires, for since the fire patrol was started, less than one third of one percent of the total area of forests has been burned; by treating cut wood with preservatives to keep it from decaying—67,000,000 gallons of creosote and zinc chloride being used for this purpose in 1909; by serving as recreation grounds for a large number of people of the west, and by keeping the game more abundant. The forest officers are in many cases appointed as game wardens in their respective forests. Considering these uses for the briefest period we must acknowledge their value and the necessity of their good management.

Let us take a general survey of the management of these forests. Beginning with the guards, we discover that they are men doing summer woork only, to assist in preventing fires and

$720.00 to $900.00 a year. Next above the guards are the rangers or men who carry out the work on the ground. They have to take care of themselves and their horses under very trying conditions, such as building trails and cabins, and often have to ride all day and night. In addition they must be familiar with lumbering, the sawmill, the handling of live stock, mining and the land-laws. Rangers must have vigorous constitutions and be in perfect health. They are paid from $900.00 to $1500.00 a year and are directly under the nearest supervisor who has charge of a national forest and who, therefore, has a very responsible position, since he manages a public estate worth millions of dollars. He must have a good knowledge of timber, and lumbering, the live stock industry, land laws and office work but above all he must be able to deal with all classes of men. The majority of supervisors are professional foresters. They receive a salary of from $1500.00 to $3000.00 a year. Both rangers and supervisors are appointed only after passing civil service examinations and none but competent men, who are able to withstand the hardships of such a position are appointed. Though forestry is not a paying profession, financially, the men who choose it rarely regret the choice, partly because it is wholesome and partly because it is pioneer work. Above guards, rangers, and supervisors is the forest service at Washington, whose work is distributed in districts directly under the Forester and Associate Forester at the Capital.

Thus far in this discussion, no attention has been given to any action on the part of the States, in relation to the forestry problem, which might lead one to think that little or nothing has been or is being done by State authorities. However, such is not the case, and to show that the States are and have been interested in this problem, we shall direct our attention first to the declaration of Governors for the conservation of natural resources. A committee of five Governors was appointed by a conference of Governors from all the States, which met at the White House in May 1908, to prepare and submit an article relating to our natural resources. The declaration as drawn up by the committee and unanimously accepted by the governors is lengthy but the main clause in it is, "Let us conserve the foundations of our prosperity." And what are these foundations, if not our forests and their products? The lines along which the States have been acting are the passing of laws to protect the forests from trespass and fire, and the establishment and the promotion by various means of State Forests. The State Laws encourage forestry may be classed under two heads; first those creating forest commissions and state foresters; and second, those offering inducements to plant forest trees or to maintain forests. The latter have been unsuccessful in most cases, and as they were poorly framed were declared unconstitutional. At present, the area of the state forest reserves amounts to 2,999,440 acres with New York in the lead and Pennsylvania and Wisconsin closely following. The States are aided greatly by the forest service, which co-operates with them in making examinations and in outlining policies for their protection and proper use. There are now thirty-six men holding official state positions as foresters, and there are thirty-three state organizations each doing its best to help the progress of forestry in the United States.

The forest service extends its help not only to the States but also to individuals and since three-fourths of all our land is in the hands of private parties the real forest problem is to induce private owners to practice forestry. The Government is doing everything possible to promote the practice of private forestry. For instance in 1903, 63 new publications and 102 reprints were made and the names on the mailing lists were increased to 750,000. Three hundred and fifty-nine public addresses were made by members of the forest service, and, 995 lantern slides were loaned or sold to persons outside the service. Experiments are carried on in conjunction with railroad companies, telephone companies, etc. Plans are made, on application, for areas of private forests to secure the best financial results—present and future—for the owners; and men have been sent out by the Government to see that the plans are executed in the most advantageous manner.

This leads us to the consideration of the co-operation between foresters and lumbermen, a most vital point since the question rests with the lumbermen as to whether we shall conserve or destroy our forests. Not many years ago, the lumberman believed the forester was his enemy. In many cases he was justified since the majority of foresters laid such stress on the preservation of our forests that he did not realize that "The principal idea of forestry is the preservation of our forests by wise use" or that practical forestry means conservative lumbering. Do they not see that practical forestry is a good business investment since conservative lumbering pays in the proportion of the value of the second crop and it rests chifly in their hands to make the second crop valuable? It would seem that they did since they are becoming more and more friendly to the principles of forestry and the time will soon come, when the forester and lumberman will work hand in hand.

There are four national forest associations—The American Forestry Association, The Appalachian National Forest Association, The International Society of Arborictulture, and the Society of American Forests. At the head are such men as the Honorable James Wilson, D. A. Tompkins, General William Palmer, and Gifford Pinchot. These men have the interest of the nation and the advance of practical forestry at heart, and write and make addresses with the view of helping the people realize the great importance of the subject.

Twelve years ago there were no schools of forestry in the United States and professional foresters were obliged to go abroad to secure their education. But in 1898 such schools were established at Cornell University in New York and Biltmore in North Carolina. Others have followed in quick succession till today there are twelve in this country which are graduating more and more students every year. This is shown in the following statistics:

Years—1901-02-03-04-05-06-07-08-09
No. Graduated— 6 -13-20-38-40-45-48-60-72

Sixty-five of these students, or about one-fifth of the total, went abroad to complete their studies. According to Dr. Schenck of the Biltmore School, about two-thirds of the number graduated became professional foresters and the other third abandoned the subject after graduation. When these schools were first established, it was advantageous, to say the least, for the student to complete their education abroad, but today, thorough training may be had at the schools of forestry in the United States.

Finally what is to become of the forestry movement in the United States? Has it not progressed rapidly in the past twenty years? Is there not hearty co-operation between the Federal Government the individual states, individuals, lumbermen, and educators? Have we not the results obtained abroad to help us? And are not our forests well worth conserving? To all of which questions there is but one answer and we can almost see the glorious future forestry is to have in this country. The prospects are all that could be desired but without constant faithful care, wise management, and the hearty co-operation of the public, our future cannot hope to be what it should be—bright, prosperous and successful.

Hoboken, N. J.

NOTE AND COMMENT

WANTED.—Short notes of interest to the general botanist are always in demand for this department. Our readers are invited to make this the place of publication for their shorter botanical items. The magazine is issued as soon as possible after the 15th of February, May, August and November.

GALLS ON PEPPERMINT.—On October 16th while botanizing in a swampy meadow, I saw a great number of peppermint plants which seemed to have a single flower bud at the top of the stem instead of a number of flowers around the stem as usual. Every plant bore this central bud. Being convinced that it could not be a flower bud, I opened one and found it was a gall containing two tiny yellow larvae. There were no signs of flowers, past or present on any plant.—*Miss Pauline Kaufman, New York.*

THE USE OF BOTANY.—"Of what use is it all?" The inquiry is perfectly natural but to it there are three sufficient answers. First, scientific study gives happiness to some people who are as much entitled to their own kind of uplifting enjoyment as are those who take pleasure in literature, art, music or the drama; and their preference should receive the same sympathy and respect as are accorded the latter. Second, man rises in the cosmic scale chiefly through effort and next after conquest of himself scientific investigation of the world about him offers the most natural worthy and effective field for the uplifting of his powers. Third, the history of science has shown that those scientific discoveries which have resulted in great practical benefit to mankind have been made in the most unexpected places, even in the most unpractical subjects; and it is quite impossible to predict where, on the broad surface of expanding knowledge, the next practical development will spring forth. Hence the only logical way is to encourage the advancement of all phases of knowlege—trusting with faith born of experience that sooner or later some result will appear of such value as to pay many fold for it all.—*Dr. W .F. Ganong in The Teaching Botanist.*

GRINDELIA SQUARROSA IN NEW YORK.—We are yearly finding plants new to this section. Among these, moth mullein (*Verbascum Blattaria*), velvet leaf (*Abutilon theophrasti*) great ragweed (*Ambrosia trifida*) and others, formerly absent or very rare, are now becoming plentiful, making so many more bad weeds to contend with. One of my best finds for 1910 in this eastern New York locality is *Grindelia squarrosa,* the broad-leaved gum plant, whose home is in Illinois, Minnesota and the southwest. It has not before been reported from New York. I found it on a hillside pasture and it is fully established, for the colony has many thousand plants, and covers two acres or more—scattering in places, but in others as crowded as it can grow. It looks very pretty with its bright yellow blossoms, and they are plentiful enough to distinctly show the color at a distance of three-fourths of a mile. But it is terribly gummy and soils the hands and everything it touches, and often taking it from the press you can scarcely get the papers away from it, and they can never be used again. How it comes here in quantity no one can say. Perhaps in western grass seed. If so it should appear elsewhere, and it seems strange that it should pass over hundreds of miles of intervening country, to locate here, for its first eastern home. From the way it flourishes and is spreading, it bids fair, at no distant day, to cover the hillsides of New York and New England as plentifully as daisies and buttercups. I only add that the place where found is 60 miles north of Albany and but a mile from the Vermont line.—*F. T. Pember. Granville, N. Y.*

VARIETIES.—It is interesting to note that many of the characteristics that we ascribe to varieties are found throughout the plant world and are likely to crop out in the most diverse places. Among these may be mentioned dwarfs which may appear in any species. Other equally common forms are divided leaves, fasciated stems, white flowered forms, double flowers, thornless forms, smooth forms in hairy species, weeping or drooping forms, rose-colored forms of blue or purple flowers, yellow berried forms of normally red or black species, yellow flowers among red flowered forms, and so forth. A little search among the wild plants of one's own neighborhood will usually yield a variety of such specimens. Most of them come true from seed or may be subdivided in various ways if one desires to multiply the variety. One who has a taste for gardening may find the cultivation and study of such forms a most absorbing pastime.

SCIENCE TO FIT THE FACTS.—Shortly after the Darwinian theory was announced with its implication that everything that exists in nature has been called into existence because useful to the organism possessing it, it became the fashion to interpret every structure in this light with the result that some very unscientific deductions were made, many of which still linger on in popular works to vex the incautious student. A good example of these interesting misinterpretations is found in the function ascribed to the juice of the milkweed. This, we are gravely told, exists for the purpose of protecting the plant from the depredations of insects. "It has been found that the outer covering of the stem is extremely delicate and that the tiny claw-like feet of insects that attempt to crawl up the stalk will cut through this covering sufficiently to cause the feet of such visitors to become sticky with the milky fluid. This not only discourages would-be pilferers of the flowers' sweets but makes it quite impossible for them to reach the top of the tall stem." This statement is taken from a book published during the present year. Had the author gone to nature instead of to books for his information, he would have found ants in plenty travelling up the stems, various beetles feeding among the blossoms, and larvae of butterflies feeding on the leaves.

Number of Plant Species.—Theophrastus (twenty-two centuries ago) knew about 500 species of plants of all kinds; Linne (two centuries ago) knew 8,551 species; DeCandolle (in 1819) reckoned 30,000 species of Phanerogams, alone; Lindley (in 1845) reckoned 79,837 species of Phanerogams; Duchartre (in 1885) placed the number of Phanerogams then known at 100,000 species, and of Cryptogams at 25,000 species; Saccardo (in 1892) estimated the known species of plants of all kinds at 173,706; while a very recent calculation by Bessey (in 1910) places the number at about 210,000.

Our Unsubdued Wildflowers.—As a matter of sentiment we may regret the disappearance of many choice wildflowers from the haunts of men, but a cold business proposition cannot take sentiment into account and without emotion city building lots are staked out in the midst of many a floral paradise. The wildflowers are diminishing in the thickly settled portions of our country in spite of our best efforts to the contrary, but it is comforting to reflect that there are vast areas even close to civilization from which it will be practically impossible to ever eradicate the flowers. No one who has ever crossed the state of Pennsylvania from east to west will doubt this assertion. The railways wind along in narrow valleys from which rise hills too steep for farming, too steep for pasturing, almost too steep for climbing and fit only for growing timber. In such retreats the wilflowers will linger on in no fear of extermination. The botanist may penetrate to their haunts but no thoughtless band of picnickers will devastate the landscape, nor will the march of civilization blot out whole colonies of rare plants. In all broken country this condition exists; the prairie flora, is the one that is on the way to extermination. Already a piece of native prairie is hard to find and the flowers are disappearing before the plow.

EARLY PLANT NAMES.—It is popularly supposed that Linnaeus was the originator of the binomial system of naming plants and the first botanist to give but two names, a generic and a specific, to each species. This is quite incorrect. Two centuries before the time of the famous Swede there were writers on plants who knew them by only two names which were clearly equivalent to genus and species. The good example they set was not followed, unfortunately, and it remained for Linnaeus to give this method sufficient prominence and authority to make it accepted by later writers. Before the day of generic and specific names plants were commonly designated by a string of Latin words. Thus our common adders tongue (*Erythronium Americanum*) was called "*Dens caninus flore luteo,*" the Christmas fern (*Polystichum acrostichoides*) was "*Filix mas foliis integris auriculatis,*" and the walking fern (*Camptosorus rhizophyllus*) masqueraded as *Phyllitis parva saxatilis per summitates folii prolifera.* The wonder is that the world waited until the time of Linnaeus for so manifest an improvement.

BACTERIA IN THE SOIL.—Most people are fairly familiar with the fact that the soil is by no means a mere collection of dead and inert particles of sand and clay. Billions of bacteria are found in every inch of the surface layers and the soil may be said to be alive in the most literal way. Many of these bacteria are helpful species engaged in turning decaying vegetation into nitrates for the use of other crops, but others there are in plenty that cause diseases in plants or animals. The bacteria causing plant diseases are among the more interesting. In this class are the causes of wilt in various plants, club-root of cabbage, onion smut, scab, black-rot and similar troubles. The germs of these diseases can live in the soil for one or more seasons waiting to infest the next lot of plants that way be grown. Not only are they hard to eradicate when they once get in but they may infect other fields in a variety of ways; from the hoofs of animals or the feet of laborers who visit new fields, in feed or manure, even from tools that have been used in the infested ground. Cases are also known in which the infection was spread by rains washing down the germs from higher land.

RARE IOWA PLANTS.—Noting your article concerning the discovery of *Tribulus terrestris* at Joliet, will say, regarding the fact of Joliet being the third inland station, that this plant has been known from at least two localities in Muscatine County, Iowa for the past twelve or fifteen year and was reported by Reppert, Barnes, and Miller in a Flora of Scott and Muscatine Counties published in 1900 (Proc. Davenport Acad. Sci. VIII—p. 210). At that time it was reported from Muscatine and Fruitland, and having collected it for several years at the latter place I can vouch for the fact that it is still well established. Now I have a new find to record, which may however prove, like the caltrop, to be better established or more widespread than we now think, but if so, I will be glad to know more concerning its distribution. Some years ago I found at Fort Dodge, (Ia.) a plant which, at first glance, I took to be a *Rumex* but closer examination disproved this without, however, clearing up the mystery. A short time ago in studying a series of *Atriplex* from Norway, I recognized my mysterious plant and comparison proved it to be *Atriplex hortense L.* This has, I believe, been reported from eastern ballast heaps, but I have never heard of its occurrence inland.—*M. P. Somes, Iowa City, Iowa.*

Getting Rid of Dandelions.—Some apprehensive landowners are after the dandelions early and late each spring and after a good deal of back-breaking labor digging them out fail to see that their premises are any more free from dandelions than some indolent neighbor who refused to dig a weed. As a matter of fact, the man who refuses to dig dandelions except for "greens" has much reason for his view of the case. Digging dandelions may actually have the effect of multiplying them since the roots can send up new shoots and usually do so, thus producing two or more where the one was originally. Moreover, the open spot left where a plant was dug forms just the right seed bed for new weeds to grow. Possibly the best way to get rid not only of dandelions but other weeds in the lawn, is to feed the grass well, set the lawn mower rather high and let the grass run them out. Most of the weeds that trouble the lawn are such as require an open space in which to spread out their leaves. Letting the grass grow tall obliges these plants to lift their leaves and the mower gets them. Grass can endure this frequent shearing, but the other plants cannot.

The Increase of Dodder.—Many years ago the clovers in the United States were free from dodder (*Cuscuta sp.*) although the botanists were well aware that in Europe clover and lucerne (called alfalfa in the United States) were often attacked by this interesting parasite. Between twenty-five and thirty years ago the first specimen of dodder attacking clover was sent to me, and from that time to the present there has been a notable increase in the amount of dodder in the country. Each year I have my attention called more and more forcibly to the fact that dodder has come to be a very serious menace to the grower of clover and alfalfa. We have here a most interesting example of how a parasite may invade a country and spread with a good deal of rapidity. Apparently it will not be long before our clovers and the alfalfa will be as badly infested with dodder as they are in Europe. I might say that not only the regular clover dodder of the Old World has come into this country and spread so rapidly, but at least one native species of dodder has sufficiently changed its habitat to become a serious pest upon the clovers.—*Charles E. Bessey.*

WEED IMMIGRANTS.—Three years ago in making a garden, the writer had occasion to break up a piece of prairie sod that had not been cultivated for twenty years or more. So far as could be seen, and as shown by adjacent pieces of the same sod, weeds were practically absent, but in the piece of ground broken up all the old familiar species at once appeared to dispute possession with the crops. Some of the most persistent of these are burdock, clotbur, plantain, dandelion, shepherds purse, prickly lettuce, sour dock, curled dock, mullein, thistle, purslane, butter-and-eggs, pigweed, white amaranth, spurge, quack grass, pepper grass, rag-weed, horse-weed, fleabane, mustard and sweet clover. It would be a difficult matter to say where they all came from. Doubtless many were lying in the soil waiting for an opportunity, others probably were from plants that year after year had grown among the grasses without attracting notice, and still others were probably blown onto the soil from other fields. It is quite likely that any piece of grass-land is thus seeded with weed seeds every year but the grass is too well established to permit them to grow.

SCHOOL BOTANY

Successful Teaching.—The measure of the teachers success is the degree in which ideas come, not from him but from his pupils. A brilliant address may produce a temporary emotion of admiration, a dry lecture may produce a permanent impulse in its hearers. One may compare some who are popularly known as gifted teachers to expert swimmers who stay on the bank and talk inspiringly on analysis of strokes; the centrifugal teacher takes the pupils into the water with him; he may even pretend to drown and call for rescue. This was the lesson taught me by the great embryologist Francis Balfour of Cambridge who was singularly noted for doing joint papers with his men. An experiment I have tried with great success in order to cultivate centrifugal power and expression at the same time is to get out of the lecture chair and make my students in turn lecture to me. This is virtually the famous method of teaching law re-discovered by the educational genius of Langdell; the students do all the lecturing and discoursing, the professor lolls quietly in his chair and makes comment; the stimulus upon ambition and competition is fairly magical; there is in the class-room the real intellectual struggle for existence which one meets in the world of affairs. I would apply this very Socratic principle to every branch of instruction early and late, and thus obey the "acceleration" law in education which I have spoken of above as bringing into earlier and earlier stages, those powers which are to be actually in service in after life.—*Dr. H. F. Osborn in Science.*

Plants in the School Garden.—The greater part of the school garden is likely to be devoted to growing vegetables and flowers by the children, but no matter how large or small the class may be, a part of the ground should be set aside for specimens of unusual vegetation. In this plot may be grown such specimens as flax, hemp, hops, tobacco, sugar-cane, cotton, sorghum, broom corn, peanuts, sweet potatoes, artichokes, millet, oats, barley, cow-peas and many more. A similar plot may well be devoted to plant curios such as clovers with four and five leaves, "everlasting" flowers, albino forms, dwarf forms, cactus, edelweiss, bleeding heart, autumn crocus, four o'clocks, and evening primrose. Room ought also to be found somewhere for a line of shrubbery containing plants of special interest such as the barberry, bladder-nut, hop-tree, silver bell, witch hazel, prickly ash, buffalo berry, papaw, yucca, bitter sweet, burning bush, and gingko. A course in gardening is not alone for instruction and practice in raising vegetables and flowers. Properly conducted it should open the minds of the children to the beauties of all nature and leave them with a lasting interest in things out of doors.

Material for Study.—There are very few things in the high school botanical course that cannot be studied at first hand and this without recourse to many pickled specimens. As a general thing the young student recoils at preserved material but if fresh material be insisted upon, the teacher should have a definite place in which to collect it, and not be expected to range the countryside for miles around in search of illustrative specimens. Few besides the energetic teacher realize the amount of time needed for collecting; certainly high school boards do not. The securing of proper material should be made part of the day's work and if the teacher be allowed to take the class on field trips in search of it, during the periods allotted to the study, the results are excellent, since the pupils see much more of botany than is represented by the specimens brought back. Most teachers, however, will find it easier to have some place in which to grow their material. If the school has a school garden, one should insist upon a part being devoted to the growing of plants with tendrils, thorns, cladophylls, and other structures that are needed. Often, however, the teacher will be obliged to grow such things in his home grounds and get his reward entirely from the consciousness that his subject has been properly taught.

Growing Mucor.—Everybody who takes up the study of fungi becomes acquainted with the black mold (*Mucor*) which appears on bread and other food products, but possibly because it is so abundant and ubiquitous little attention is paid to special methods of cultivating it. One of the best schemes we have seen for getting specimens that the dullest pupil cannot fail to see well was originated by Mr. F. A. Houghton. By his method a drop of clear gelatin is placed on a glass slide, some mold spores sown in it and then placed in a moist chamber for growth. In a short time the mycelia may be seen pushing into various parts of the food material, and the young sporophores rising from it. If the specimens are properly cared for they may be examined several days in succession and will give the pupil a better idea of the habits of this mould than any series of prepared slides or living material taken from bread or other moldy objects.

Growth Rate of the Giant Cactus.—Some investigations recently made concerning the rate of growth of the giant cactus (*Cereus giganteus*) have resulted in some rather astonishing information. Cacti of all kinds are known to be rather deliberate in adding to their bulk and this species is no exception. Specimens less than five inches high are known to be ten years old while the fairly large specimens, running up to fifteen feet or more in height, require at least sixty years to attain this size.

KEY TO THE APETALOUS DYCOTYLEDONS.*

1 Shrubs and trees (2)	
2 Some of the flowers in catkins (3)	
3 Staminate flowers, only, in catkins (4)	
Leaves simple; nuts in involucres.	Fagaceae. (G. 337. B. 330)
Leaves pinnate; nuts without involucre.	Juglandaceae. (G. 330. B. 322)
3 Both pistillate and staminate flowers in catkins (5)	
5 Fruit fleshy, a sorosis.	Moraceae. (G. 344. B. 339)
5 Fruit dry (6)	
6 Catkin globular.	
In racemes; nutlets two-celled.	Hamamelidaceae. (G. 452. B. 488)
Solitary; nutlets one-celled.	Platanaceae. (G. 454. B. 490)
6 Catkins cylindrical or oblong.	
Ovary many seeded; seeds with pappus.	Salicaceae. (G. 320. B. 307)
Ovary one-seeded.	
Ovary one-celled; fruit often fleshy.	Myricaceae. (G. 329. B. 320)
Two-celled; fruit often winged.	Betulaceae. (G. 332. B. 326)
2 None of the flowers in catkins (7)	
7 Leaves opposite (8)	
8 Fruit a samara.	
Samara, double, two winged.	Aceraceae. (G. 557. B. 607)
Samara, single.	Oleaceae. (G. 650. B. 723)
8 Fruit not a samara (9)	
9 Fruit dry, three-seeded.	Euphorbiaceae. (G. 540. B. 585)
9 Fruit a drupe, or druplike.	
Stamens two.	Oleaceae. (G. 650. B. 723)
Stamens more numerous.	
Three; parasitic plants.	Loranthaceae. (G. 351. B. 344)
Four to eight; not parasites.	Eleagnaceae. (G. 590. B. 646)
7 Leaves Alternate (10)	
10 Style or stigma, one.	
Calyx free from the ovary.	
Anthers opening by valves.	Lauraceae. (G. 413. B. 435)
Anthers not opening by valves.	Thymelaceae. (G. 589. B. 645
Calyx adherent to the ovary.	
Shrubs; ovules two to four.	Santalaceae. (G. 349. B. 345)
Trees; ovule one.	
Stamens four.	Elaeagnaceae. (G. 590. B. 646)
Stamens more.	Cornaceae. G. 623. B. 689)
10 Styles or stigmas, two or more (11)	
11 Two, three or four.	
Fruit a samara or drupe.	
Shrubs or vines.	Rhamnaceae. (G. 561. B. 611)
Trees.	Ulmaceae. (G. 344. B. 337)
Fruit a capsule.	
Two-celled.	Hamamelidaceae. (G. 452. B. 488)
Three-celled.	Euphorbiaceae. (G. 540. B. 585)
11 Five to nine.	
Leaves simple.	Empetraceae. (G. 551. B. 598)
Leaves pinnate.	Rutaceae. (G. 537. B. 581)

*Numbers in parenthesis after family names, refer to the pages in latest editions of Gray's and Britton's manuals, respectively. For keys covering the other great plant groups, see previous issues.

s (12)

12 Flowers lacking a perinanth (13)
13 Flowers in spikes. Piperaceae. (G. 320. B. 307)
13 Flowers solitary, minute.
Stamens numerous, leaves whorled, dissected. Ceratophyllaceae. (G. 389. B. 408)
Stamens and styles, one or two.
Leaves opposite. Callitrichiaceae. (G. 549. B. 596)
Leaves alternate. Podostemaceae. (G. 441. B. 472)

12 Flowers with calyx or calyx-like involucre (14)
14 Ovary inferior (15)
15 Stamens five, style one. Santalaceae. (G. 349. B. 345)
15 Stamens more or less than five, styles various.
Stamens six or twelve. Aristolochiaceae. (G. 351. B. 347)
Stamens one to ten.
Stigmas two. Saxifragaceae. (G. 444. B. 484)
Stigmas one, three or four. Onagraceae. (G. 594. B. 651)

14 Ovary superior, sometimes enclosed by the calyx (16)
16 Style or stigma one (17)
17 Ovaries 4 or more, one ovuled.
Stamens on the receptacle. Ranunculaceae. (G. 392. B. 411)
Stamens on the calyx. Rosaceae. (G. 454. B. 490)
17 Ovary one (18)
18 One ovuled, one seeded.
Flowers monoecious or dioecious. Urticaceae. (G. 344. B. 341)
Flowers perfect, calyx entire, colored. Nyctaginaceae. (G. 375. B. 382)
18 Many ovuled.
Stamens four, opposite the sepals. Lythraceae. (G. 591. B. 648)
Stamens five alternating with sepals. Primulaceae. (G. 643. B. 713)

16 Styles and stigmas more than one (19)
19 Ovules one to three; stigmas two to five (20)
20 Fruit three seeded. Euphorbiaceae (G. 540. B. 585)
20 Fruit one seeded.
Plants with stipules.
Stipules sheathing the stem. Polygonaceae. (G. 353. B. 350)
Stipules not sheathing. Illecebraceae. (G. 376. B. 387)
Plants without stipules.
Calyx scarious bracted. Amaranthaceae. (G. 371. B. 377)
Calyx naked.
Leaves alternate. Chenopodiaceae. (G. 364. B. 368)
Leaves opposite. Caryophyllaceae. (G. 377. B. 387)
19 Ovules four or more, styles two to twelve (21)
21 Leaves opposite.
Fruit a capsule, four or five valved. Caryophyllaceae. (G. 377. B. 387)
Fruit a utricle, circumscissle. Portulaceae. (G. 387. B. 384)
21 Leaves alternate.
Fruit a berry, four to ten seeded. Phytolaccaceae. (G. 374. B. 381)
Fruit dry.
Capsule five celled. Crassulaceae. (G. 441. B. 473)
Utricle, circumscissle. Amaranthaceae. (G. 371. B. 377)

EDITORIAL

Beginning with our next volume we have decided to stop subscriptions at the end of the time for which they are paid. This is not done to avoid being defrauded by those who fail to pay their subscriptions, for as a matter of fact, we have not lost fifteen dollars in this way since we began publication. Most of our subscribers renew their subscriptions very soon after being notified and we think that the small number who fail to do so should not keep us from joining the ever incresing number of publishers who have adopted a modern way of doing business. At the same time the editor is well aware that it is not always convenient to renew as soon as subscriptions expire and personally holds in high regard those publications to which he subscribes that are not insistent upon renewal until he finds time for it. With these facts in mind we are quite willing to extend the time for anyone who for any reason does not care to renew promptly. All that is necessary is to drop us a line instructing us to continue sending the magazine until ordered to stop. Payment may then be made during the year when most convenient. We have a considerable number of such letters on file already and we hope nobody will go without the magazine because they are unable to renew promptly. The subscription price is so low that the cost of renewing is not worth consideration.

* * *

In his excellent book "The Teaching Botanist" Dr. Ganong in referring to botanical publications says: "But as to a journal for the teacher and general reader, we have as yet none that even approaches a satisfactory character and the lack of it is another illustration of the weakness of this science on the literary side. Such a journal should be accurate in fact, literary in tone, artistic in dress, and comprehensive in its scope—having departments of leading articles, contemporary discoveries, educational advances, editorial comment, reprints of botanical classics, book reviews, biographical and other news; and it should cover these subjects so systematically that nothing of consequence would be missed and no teacher or other person of botanical interests could afford to go without it.' Dr. Ganong makes the mistake of attributing the lack of such a publication to a weakness on the book side of botany. The real cause is due to a weakness on the pocket-book side. Having been concerned in the publication of no less than seven different botanical publications five of which are still doing business though far from Dr. Ganong's ideal, the editor is inclined to doubt whether a magazine of the kind outlined would ever prove successful. Both this magazine and *The Plant World* started out to become just such magazines but failed to receive the support of the very people supposed to be most interested, and later the proposed *Dorfleria* has been abandoned for the same reason. At the end of its second year *The Plant World* had less than 300 paying subscribers and this magazine was not much better off when it completed two years of work. As a matter of fact the botanists of the country seldom subscribe for publications in their line. The institution with which they are connected subscribes for a copy, of course, and they depend upon this for their information. Since this magazine has been published we have received nearly ten thousand requests for sample copies, but, alas, our circulation lacks several hundred to reach that attractive number. Botanical magazines, like everything else, are subject to evolution, and those that are now doing business illustrate very well the survival of the fittest. The ideal magazine of the botanist can be kept alive just as long as some kind-hearted individual will finance it, but left to itself it has no more chance of surviving than some new "creation" of the gardener under similar circumstances. The great mass of the botanically inclined are interested almost entirely in collecting and exchanging plants. The philosophical botanists and botanizers must always be few and far between, but such as there are we are pleased to number them among our subscribers.

* * *

In the not very distant future, this magazine expects to increase to forty pages an issue with no increase in the subscription price. When most magazines enlarge the price enlarges likewise, the editors evidently reasoning that a smaller circulation at an increased price per copy is better than a wider read ing at the old figure. Every time we have increased this magazine, which has been several times, the increased circulatian has made up for the increased cost of making and we expect the same results again. Before we can enlarge, however, we must have a larger amount of contributed articles and notes. There has been a gratifying response to our request in the August issue, but, like certain eminent financiers we still want more.

BOOKS AND WRITERS.

"The Landscape Beautiful" is the rather hackneyed title for a series of essays on the utility of the natural landscape and its relation to human life and happiness, by F. A. Waugh. Those who take up the book in the expectation of finding it a manual of park and garden making will be disappointed, but the disappointment should be lost in the delight which the book must give to all who take pleasure in the beauties of nature or who believe that the esthetic has a value as well as the practical. There are seventeen essays in all, and they range from a discussion of the weather and the ministry of trees, to the ownership of scenery, the art that mends nature and the landscape in literature. The author has a keen appreciation of the values of the landscape and expresses it in a most attractive manner. The publishers have seconded the author by giving the text an appropriate setting, which is further beautified by fifty artistic reproductions of landscapes from all parts of the country. The Orange Judd Co. are the publishers and the price of the book is $2.00 *net.*

After forty years of teaching Dr. W. J. Beal has retired from the chair of Botany at the Michigan Agricultural College and in the future will reside with his son-in-law Ray Stannard Baker in New York. Though still hale and hearty, Dr. Beal has concluded that at the age of 77 he has earned a rest. May he long live to enjoy it! His services to botany are too well known to need repeating here. He is one of the few remaining examples of the old time field botanist who though quite at home in the laboratory and class-room finds great pleasure among the growing things. Dr. Beal is succeeded by Dr. Ernst A. Bessey, son of Dr. C. E. Bessey of the University of Nebraska. The younger Bessey is a botanist of much promise and has held various important positions under the government and elsewhere, but his fame has been rather overshadowed by that of his distinguished father.

Our ornamented shrubs have ever been a difficult problem for the botanizer. Cultivated chiefly for their beauty, they hail from distant lands and other inaccessible regions, and to run them down in the floras of their respective countries requires more money, time and labor than the collector cares to devote to them. Nor is the task of assembling the descriptions of all these in one book an easy one and in addition to locating the species in the books, it requires great familiarity with the stock of gardener and nurseryman in order to include those entitled to admission. That such a book has at last been made is likely to be the verdict of all who have had the pleasure of looking into Apagar's "Ornamental Shrubs of the

United States," published by the American Book Company. This is a real botanical manual of the shrubs with numerous keys such as are found in other manuals, accurate descriptions and a profusion of illustrations but with little, if any, "popular" information. The descriptions, it may be added, are as untechnical as possible in a work of the kind. Common names are freely used and the methods usual in propagating each species are noted. The shrubs are arranged according to modern ideas of sequence and thus the treatment corresponds to that in current botanical manuals, yet we find many familiar families of the flower manual lacking because there are no shrubs in them, while, the names of various new families and genera call attention to the differences that must exist in the flora of lands having approximately the same climate. With this book in hand a walk in the parks of a great city will have much of the interest and zest that a ramble in the country has for the plant lover.

There seems to be no end to the botanical text-books designed for use in high school or college. In most of these there is little that is unique, the authors apparently depending for consideration upon their method of treating the subject. One of the latest of these is "Botany for High Schools," by Geo. F. Atkinson issued by Henry Holt and Company. The book follows the general run in being divided into two parts the first being devoted to the structure and physiology of flowering plants and the second to the spore-plants. In the latter some variations in the arrangement of the thallophytes are noted, the conjugating algae coming before the one-celled green algae and the blue-green forms following the green. In this part also is noted an inclination toward the study of "types" with but a slender thread of evolution connecting them. In thus presenting the subject the author is in good company, for practically all books written by College men take the same stand but the high school teacher knows that his pupils are little interested in types and that he must have something more than this to keep them interested. That something may well be evolution but the text books seldom emphasize it. The influence of the college is seen again in the use of the entirely superfluous word scutellum for what may as well be named the cotyledon of the corn. No directions for laboratory work are given though one infers from the text that something of the kind is expected. The author has been wise, however, in keeping such directions out of a text-book. Among errors that a captious critic might note are the careless use of terms as when a seed is called castor-bean on one page and castor oil bean, on the next, the definition of a seed makes no inclusion of the endosperm and though cells are mentioned frequently there seems no adequate discussion of the subject in the early parts of the book. It may be noted that the chemical formula given for starch on page 103 might be taken for a proteid. These, however, are minor defects. The book has the merit of being well-written, and the information conveyed in understandable language and the fundamentals are not obscured by a great number of exceptions. There are also an abundance of good illustrations. Chapters on ecology, plant breeding, evolution, plant societies and economic plants complete the book making nearly five hundred pages.

Within the year, the publishers have given us two exceedingly valuable books on the diseases of plants both by acknowledged authorities on the subject. First to appear was Duggar's "Fungous Diseases of Plants" recently reviewed in these pages and now we have "Diseases of Economic Plants" by F. L. Stevens and J. G. Hall. This latter book begins with a minimum of introductory matter relating to the origin, symptoms and care of plant diseases, fungicides, sprays and spraying and soil disinfection and then plunges into the task of describing the diseases that infest our cultivated plants. Since plant diseases do not vary with the author, the merits of a book depend upon the way the subject is treated. Duggar's book discussed each disease under the organism that causes it, the present volume treats of the diseases as they are found affecting the various species of plants. No attempt is made to describe the organisms that cause the disease the whole attention being given to the characteristic features of the disease itself and the methods of treatment. In these matters the book is both full and satisfactory. The diseases are treated under such heads as those infecting trees and timber, those affecting ornamental plants, forage crops, tropical plants and the like. The attempt of the authors to make a common name for each disease by adding ose to the name of the casual fungus is, in the opinion of the reviewer, scarcely successful. To call dry rot of the potato lasiodiplodiose, for instance does not seem to help matters. The book contains many good illustrations and nearly five hundred pages of text. It is published by the MacMillan Company at $2.00 *net.*

Three years have elapsed since the appearance of Stevens "Plant Anatomy" and now we have a second edition revised and enlarged by the addition of a chapter on evolution and a number of illustrations. Although the book is well known to students it may not be amiss to call attention to the fact that it takes up botany from the standpoint of the development and function of the tissues and beginning with the cell shows how it has been modified to form the various tissues found in the plant body. Especially to be noted with approval are the numerous explanatory diagrams of plant parts and the suggestions for additional studies. Though larger than the first edition the price remains the same, $2.00 net. It is published by Blakiston, Philadelphia.

THE AMERICAN BOTANIST

DEVOTED TO ECONOMIC
AND ECOLOGICAL BOTANY

EDITED BY WILLARD N. CLUTE

Volume XVII

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THE NODDING ALLIUM.—*Allium cernuum.*

THE AMERICAN BOTANIST

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First came the forward darlings of the Spring,
Snowdrops and violets and daisies white,
The year's faint smiles before its burst of mirth,
The soft sweet-breathing babies of the earth;
Close to her warm brown bosom nestling in,
That the wild winds take laughing by the chin.

—**Kemble.**

THE YUCCA AND THE INDIAN.

BY CHARLES FRANCIS SAUNDERS.

THE Indian was the first *American Botanist,* and of all our redmen those of the arid regions of the great Southwest have exhibited the most remarkable sagacity in exploiting the secrets of the wild plants with which they have come in contact. One of the United States Government investigators has recorded the fact that out of about one hundred and fifty known species of plants indigenous to the Moqui Reservation in northern Arizona—largely a desert reservation—these Indians have utilized in one way and another, about one hundred and forty.

The remorseless Indian policy of the government, which is de-Indianizing the Indian at a rapid rate, has already destroyed so much of aboriginal practice that one has to travel far indeed into the wool of the wild west to find Indians who depend nowadays to any extent on the native plants. Fortunately, however, there are some of this sort left—the most numerous being the Navajos whose great reservation lies across parts of northern Arizona and New Mexico. They live a sort of patriarchial, pastoral life, dwellings not in villages but each family separately from the others, moving about from place to place as fancy or need dictates and driving before them their bands of sheep, goats and horses, in which mainly their material wealth consists.

Into our Arizona camp one showery morning two Navajo shepherdesses strayed, and after enjoying our camp fire for a while, one of them tossed something from her blanket into the blaze and scraped some ashes over it. Two or three more of the same things followed and were similarly burried in the hot ashes. Each was the size and shape of a large butternut, and greenish white in color. By and by she withdrew them, and removing the charred skin, ate them, with evident relish.

"What are you eating, sister?" asked Bob, our guide, in her native tongue.

And she told him *hosh-kawn*—the Navajo word for the fruit of the widely distributed *Yucca baccata,* or Spanish bayonet, of the Southwest.

It was August, and we had passed hundreds of the fruiting plants in our travels without suspecting them of edibility; but that day we made a business of gathering a quantity of the fruit and at night had a *hosh-kawn* roast. Bob said they had roast apples "plum skinned;" but to my notion, the flavor was rather that of sweet potato. At any rate we thought them good, and they inspired respect in us for Navajo cookery.

That, however, is only the beginning of the story of the yucca's usefulness; for in some measure, the yucca has, in its time, been to the desert Indian what the date palm has been to the Arab. Besides furnishing food (the fruit is not only eaten green, but by some Indians is cured for winter use), the plant has a fibre of much value as a textile material, and in pre-Columbian times this was largely used in the weaving of garments, remains of which have been abundantly found in the ancient cliff dwellings of the Southwest. I have myself picked up in the debris about such places, pieces of well-woven cordage made of the yucca fibre, which also served in the manufacture of prehistoric sandals. This use of the yucca has now been abandoned, but the foliage still supplies an important basket material; and in the hands of an artist, very beautiful effects are obtained by combining in the design leaves which have been dried green with others which have first been bleached or browned by the weather. The narrow leaved yucca (*Y. angustifolia*) which is indigenous to much of the territory where *Y. baccata* grows, is often cut off just below the root crown, bunched together and dried to serve as whisks or brooms.

The greatest contemporary usefulness of the yucca, however, lies in its long, thick root. This is highly saponaceous, and is greatly prized both by Indians and Mexicans as a substitute for toilet soap. The roots are grubbed up, cut into handy lengths, and crushed with an axe or stone. Rubbed up in water they make a plentiful lather, which is excedingly cleansing and leaves a pleasant feel to the skin. In the ceremonial washings attendant upon the religious rites of the Indians, the use of commercial soap would be sacrilege, only yucca suds being permitted. *Amole* is the name by which their soapy root is known throughout the Southwest, and its value has not escaped the notice of the enterprising American soap maker, to judge from a brand of "amole soap" which I have seen in the shops of civilization.

Among the Navajos, the yucca seems to have some mystical import, and the plaited leaves are used as face masks in some of their religious ceremonies. A dance, known as the *hosh-kawn* dance, is practiced among them—a night ceremony, in which the development of the yucca plant from the barren clump of winter leaves, through its flowering stage, to the time of fruitage, is dramatically represented.

Pasadena, Calif.

EXPERIMENTS WITH THE NODDING ALLIUM.

By Willard N. Clute.

ONE can never tell, until he tries, what can be made out of some wild plant that may strike his fancy. In a few cases the best of treatment in the garden only inclines a specimen to grow more vigorously, but in others the flowers may become larger, more abundant and even produce other colors than those usually found afield. Frequently, too, single flowers show a tendency to double when given good cultivation.

One of these wildings with which the writer has recently been experimenting, is the nodding allium (*Allium cernuum*). As it grows in its native haunts it is sufficiently decorative to deserve a place in the flower garden but under cultivation it takes on additional beauty as our frontispiece, from a photograph, clearly shows.

In color the flowers range from a rather deep pink to nearly white and some experiments have been carried on to discover, if it is possible to breed up a pure race of pink flowered plants and another of white flowered ones. At the beginning, the fields were searched for specimens approaching nearest our ideal and these were removed to the garden to serve as the stock from which to breed. Seeds of the individuals showing the deepest color and others from the paler specimens were planted separately and when the young plants were large enough they were transplanted to the nursery rows. The work of transplanting any species of allium is easy: the tops may die but there is enough nourishment stored in the tiny bulb to tide the plant over the period of getting established.

It seems to require two years from seed before the plants of this species become large enough to bloom. In the second summer, then, the plants from the first experiment began to bloom and in this there were several surprises, for both sets of seeds had produced plants showing the two colors pink and white. There was this difference, however, the bulbs from seed of white flowered plants gave a great many more pale forms than those from pink flowered plants, while the latter gave nearly all pink flowered bulbs and among them some with flowers of deeper pink than any we have ever seen afield. It is apparent, then that some progress has been made in separating the two colors. Continuing the work, the seeds from the deep pink flowers have been planted and also another lot of seeds from the palest forms, and we are inclined to predict that the new lot of bulbs will show greater advances in the direction we have marked out for them than the first lot did. The first lot of bulbs will be destroyed with the exception of the best specimens which will be retained for breeding purposes. Had we been in a hurry to have the two colors true, we should have very carefully pollinated the plants, pollen from white flowers on white flowers and similar treatment of the pink flowers, and our failure to get flowers of a single color is likely due to a mixing of the two strains in pollination, but the work has been rather a matter of a pastime than of a desire to achieve exact results. What we have accomplished, however, foreshdows what may be done with the plants if one takes them up in earnest.

LEAF MARKINGS OF PLANTS.

AMONG the most familiar objects of our fields and gardens are such plants as the red and white clover with definite light-colored markings on the leaflets. Another equally prominent plant in gardens is the ribbon-grass (*Phalaris arundinacea picta*), whose leaves show variegated longitudinal bands of white and green color.

Some time ago the writer began to collect data on the native and introduced plants of Ohio which show any definite type of markings. The problem is rather difficult since the markings usually disappear when plants are dried. It becomes necessary, therefore, to become acquainted with the plants in the living condition. During the past year a considerable number of species showing markings of various kinds have been observed, and the list could without doubt be considerably extended.

It has usually been customary to ascribe some purposeful effect or utility to the markings on the animal body and to the fantastic patterns shown by many flowers. It is open to question, however, whether such an assumption should be generally applied. The markings on the leaves of plants are favorable objects in this connection and may throw considerable light on the subject.

In many species, certain individuals have the markings while others lack them. There are probably elementary species present which might be segregated. These forms should make interesting material for the study of mutations and inheritance. In some species the markings are only on the younger leaves, in others only in connection with the inflorescence and thus on the latest leaves to be developed.

The markings of the leaves studied may be grouped under three general heads as follows:

1. Markings due to abnormal or diseased conditions, or the so-called variegations.
2. Markings more or less accidental, depending on some internal structure and evidently having no relation with the development of a definite pattern.
3. Markings which are of more or less definite patterns not dependent on fundamental structures.

Under the first group mentioned above would fall such forms as *Phalaris arundinacea picta,* already mentioned and the numerous variegated species commonly cultivated in greenhouses. The white bands or spots being due to a lack of chlorophyll in the parts. White stripes are frequently to be observed in young plants of corn (*Zea mays*), and occasionally the entire plant is white. These latter individuals usually do not survive long.

The leaf-markings distinguished in the second group, namely, those depending on some structural peculiarity, are perfectly normal and may also be present generally or only on some individuals. The leaves may be covered with minute spots or dots caused by internal glands as in *Hypericum maculatum* where the dots are often black or dark blue, and as in *Boebera papposa* [*Dysodia*] where they are oval in shape and of an orange color. In most species the dots or punctations are, however, too small to be seen by the unaided human eye, although conspicuous under a lens. *Nelumbo lutea* has a peculiar light-colored marking in the center of the large pelate leaf that has some resemblance in outline to certain species of beetles. The marking is purely structural and accidental, yet were green beetles in the habit of frequenting these leaves it might be cited as a remarkable case of mimicry.

The most common markings of this general type are those which follow the venation of the leaf-blade, often forming reticulations. Examples of species with red veins and reticulations are *Hieracium venosum, Viola hirsutula,* and *Rumex obtusifolius. Argemone mexicana* is perhaps the most striking example among those with white markings over the veins. The leaves of *Mitchella repens* show a pale-green narrow stipe over the midrib and *Euphorbia nutans* has part of the midrib marked by a white streak. The leaves of *Peramium pubescens* has a beautiful white reticulation over a dark-green background, with occasional white blotches.

The most interesting examples of leaf-markings, however, come in the third group designated above. In the first place, the leaf blade may be some permanent, uniform color other than green. *Oxalis rufa* is a plant of this character. The color in such cases may have a physiological use in protecting the chlorophyll.

Numerous leaves have a silvery mottled or blotched appearance of more or less definite pattern. Among such are the following: *Hydrophyllum appendiculatum, H. macrophyllum, H. virginicum, Hepatica hepatica, H. acuta,* and *Chimaphila maculata. Smilax glauca* has the same type of markings at least in the young condition. *Cucurbita pepo* and *C. maxima* have prominent angular silvery patches, covering the leaf blade, in the angles of the veins. In the *Hydrophyllums,* the main variegation usually extends on each side of the midrib and occurs in smaller spots beyond, especially at the notches of the serrations.

Other plants having mottled or blotched leaves are *Erythronium americanum, E. albidum, Lamium album, L. maculatum, Trillium sessile* and *T. recurvatum.* In *Trillium sessile* the markings are usually very prominent, while in *T.recurvatum* they are not always visible. *Arisaema triphyllum* has beautiful reddish-brown and whitish spots on the sheathing bracts, petioles and peduncles but the leave blades are green.

The plants of the greatest interest are those with definite, often symmetrical patterns, which can have no relation to the general structure. For here we come face to face with the difficult problem of symmetrical coloration in general. *Oxalis grandis* has beautiful leaves with an ornamental brown margin. *Euphorbia marginata* has milk-white bands on the leaves surrounding the flower clusters. In the second example the claim might be made that the striking color patterns around the flowers were developed through insect selection. In the first case such an explanation would, of course, be out of the question. In *Euphorbia maculata* and *E. nutans,* the leaf blades have an irregular oval dark-red spot in the center, the latter species having in addition the white streak over part of the midrib, as mentioned above. Some individuals of *Euphorbia nutans* do not show the red spot.

Trifolium pratense and *T. repens* have light-colored ornamental markings on the three leaflets which together make a very striking and symmetrical design. *Oxalis violacea* often has a similar marking on the leaflets but it is red or purple in color.

Polygonum lapathifolium has a faint, irregular, elongated spot in the middle of the leaf on the upper side while *P. virginianum* has somewhat similar dull, reddish spots in the center of the leaves. In *Polygonum pennsylvanicum*, the leaf has a dark-colored sagitate spot in the center, the point extending in the direction of the tip of the blade. In some individuals the leaves show no markings. The leaves of *Polygonum persicaria* have a very definite dark reddish of brownish oval spot in the center. Occasionally one finds individuals having in addition a distinct band of the same color running along each margin. The central spot may also be slightly sagittate in outline. Such leaves are among the most fantastic in design to be observed and well deserve careful study.

It seems out of the question to attempt to explain the origin and presence of ornamental and symmetrical patterns on leaves from the standpoint of utility. We are led to the position that there are both useful and useless structures developed in plants, the useless markings under consideration not representing degenerations. By no exercise of the imagination could one see in these designs and patterns any use to the possessor. They have probably come about through mutative changes and represent elementary species. The beautiful colors and patterns are of as much use to the plant as the beautiful colors and forms are to a rock crystal or to a snowflake.

Because of the numerous purposeful and useful structures and functions exhibited by organisms, biology was misled far into the camp of the utilitarians. But the philosophy of life has many sides and the recent discoveries in Mendelian inheritance, mutation and orthogenesis have revealed some of its complexity.—*John H. Schaffner in Ohio Naturalist.*

PUSSY WILLOWS.

By Dr. W. W. Bailey.

NATURE is especially fond of tassels: with them she fringes the curtains of the opening year; with them she adorns many of her noblest trees. In late May we see the sturdy oaks decked out with pendant catkins; in July the magnificent chestnut bursts forth into jets and fountains of bloom. Birches, hazels, ironwoods, sweet fern and bay berry all have tassels. Even in winter we see this favorite inflorence in alders and willows not, to be sure, in open flower but in pendants that indicate the tasseled type.

The amentaceous trees usually have the two kinds of flowers separated, either on difierent parts of the same tree or shrub, as in alder, or on perfectly distinct plants as with willows. In other words willows are distinctly male and female, as commonly understood. Of course modern botany has made discoveries, too recondite to enter upon here, which would qualify these terms. Still they remain convenient adjectives and are likely to long endure.

When in bloom one learns to know the two kinds of catkin, male or female, apart, and sometimes even at a long distance. The female willow bears more greenish tassels. Close examination shows, too, the flask-like ovaries, standing in the axils of silk-covered scales. These compose the cluster. If, now, we look at the male flowers, on another plant, we find each flower to consist of two divergent stamens, subtended by a silky scale as in the former case. Neither kind has either calyx or corolla but both develop abundant nectar, to which bees, big and little, come from afar.

The term, pussy, does not apply *par excellence,* to any particular willow. Several produce the silky catkins so suggestive of little kittens running up the bough. As harbingers of spring they are loved by everybody and even before they bloom they are lovely. They vary, according to the species, very much in size. Sometimes they are very large and dark, of a sort of slate color shot through with flashes of red and gold; again they are pure silky white or a light purple or dove color. It is only in the staminate catkins that one sees the gleams of the rising sun. The pistillate ones, when in flower, are of a sickly green; when in fruit a fluffy mass of down.

Scott sings of the "wild and willowed shore" and we naturally associate willows with stream and river banks; perhaps also with grave-yards and old tombstones upon which they are often sculptured. The weeping willow has long been an emblem of grief. We recall here the death scene of Ophelia and the willow which

"Grows aslant a brook
That shows his hoar leaves
In the scanty stream."

What a touch of close observation is here! It is only the underside of these leaves that are whitened.

Willows are so numerous and varied that if it were possible to grow them all together—a specimen of each—we would have a little but much diversified forest. They are a difficult study and but few persons really know them. They are taken up by the student who loves an intricate problem of discrimination, as one regards *Carex, Potamogeton* or *Aster.* As a rule our native species are none of them large. Some alpine ones are very small. They are North Tmperate plants extending well toward the Pole and at such remote limits, as on high mountains, are dwarfed. The willow of scripture some consider to be the oleander which is, of course, not a willow at all. Speaking of *Salix Babylonica* Dr. Asa Gray used to say that "If the Jews hung their harps upon it they must have been Jew's-harps" as the branches are so very brittle.

The bark of willows is stringy and tough and, as everybody knows the twigs make good whistles. It contains a bitter alkaloid, salicine, sometimes employed as a substitute for quinine. The wood is soft, smooth and light and is used for many purposes.

Providence, R. I.

Dying as an Adaptation.—More than half the plants of the world are annuals; they spring up, reach maturity, flower, ripen their seeds and die, all within the space of a single year. Conditions, however, were not always thus. Time was when most of the plants were perennials and in the light that this fact throws upon evolution, dying itself seems an adaptation. The first plants undoubtedly lived in the water in regions warm enough to escape injury from the cold, but the ever increasing struggle with other plants for place, in time drove some of the more vigorous to take up a place in the wet lands and finally to spread to colder and drier regions. Here the problem of how to escape the cold of winter or the drouth of desert regions was encountered, and was solved by the simple expedient of dying. Before dying, however, the plant shut parts of itself up in its seeds so that though the individual might not survive, the race is sure to do so. Of course those plants that failed to form seeds and were not sturdy enough to endure the winter left no descendants to carry on the family line. In addition to the annuals there is also a large number of plants that simulate annuals to the extent of disappearing from the surface of the earth at the approach of cold or drouth, but somewhere in the soil the living parts may be found cunningly concealed in bulbs, tubers, corms and rootstocks.

NOTE AND COMMENT

WANTED.—Short notes of interest to the general botanist are always in demand for this department. Our readers are invited to make this the place of publication for their shorter botanical items. The magazine is issued as soon as possible after the 15th of February, May, August and November.

SPRING FLOWERING WITCH HAZEL.—In a recent number of the *Kew Bulletin* mention is made of a new witch-hazel from Missouri that flowers in spring like the Asiatic species of this genus. The specimens were sent from the Arnold Arboretum, but it is surprising that we must get our information via Europe. If any of our readers know this interesting plant we shall be glad to hear more of it.

FRAGRANT GENTIANS.—Have just returned, this 18th day of December, from a short walk in the Texas woods, bringing with me blossoms of closed gentian, fresh and perfect—and two of them fragrant. A sweet odor, honey-like, yet distinctively its own. Referring to Burroughs on my return to see if he had included it in his list of fragrant wild flowers I find gentian is not there. In his "Nature and the Poets" it is noticeable how a few degrees of latitude will put the most careful assertions in error; for our gentian season here in East Texas begins in October and ends only with the year, holding out long after goldenrod, turtle-head and other fall flowers are gone. Witch-hazel keeps season with the gentian; but lasts no later here in the piney woods. Has the fragrance of the closed gentian been noted before? And can some Texas reader tell me if the fringed gentian has been found in the state.—*F. G. Kenesson.* [Small's "Southern

Flora" does not credit the closed gentian (*G. andrewsii*) with a range as far south as Texas. It is reported to extend only to Georgia and Missouri. Another species which might be mistaken for it is the soapwort gentian (*G. saponaria*) which extends to Louisiana. We hope our correspondent will endeavor to discover the identity of his plant. If it is the true closed gentian the range has thus been considerably extended. If not, then the fragrance can be accounted for as characteristic of some other species.—Ed.]

The Crops of 1910.—Last year the farmers of this country produced 3000 million bushels of corn, 700 million bushels of wheat, 1000 million bushels of oats, 328 million bushels of potatoes, 512 thousand tons of cane sugar, 158 million bushels of barley, 32 million bushels of rye, 15 million bushels of flax seed and like quantities of several other crops not to mention sufficient vegetation to support all the wild animals including insects and birds. And all this was made by the plants from the carbon-dioxide in the air and water from the soil and put together in the green cells of the plant by the wonderful energy derived from sunlight.

Germination of Seeds.—An old proverb well known to the farmer runs "one year's seed, seven year's weed," meaning that if the weed crop is allowed to go to seed one year, it will take seven years to get rid of the plants that will spring up as a result. Most gardeners know that many good seeds even when carefully sown, do not all come up the first year. In some cases this delayed germination has been shown to be due to the fact that the seed-coats exclude the oxygen necessary for this process and in others, such as the nelumbo and canna the hard outer coat or testa may exclude water also. The seeds of peaches, plums and nut trees in general often do not come up until the second year unless planted in autumn so that the frost can help in splitting the hard shell. There are doubtless many other seeds that require considerable time to complete their development even after they have fallen from the parent plant and thus may fail to appear promptly when planted.

Grass Tubers.—Recently there were sent to the Department of Agriculture in Washington, some curious subterranean organs of a grass-plant which from the place of growth is inferred to be the reed grass (*Cinna arundinacea*). These organs appear like small tubers with several constrictions forming a necklace-like growth quite unlike anything known in the grass family. An examination of the structure of these objects shows that they consist of the shortened and greatly enlarged basal joints of the stem, the constrictions being formed by the modes. The specimens, although likened to tubers are more properly regarded as corms, similar to those of the crocus and gladiolus, but with constrictions that are lacking in the more familiar plants.

Plants in Dry Air.—One instinctively reasons that in a warm climate almost any plant should be able to grow if given sufficient moisture, but according to a writer in *Plant World* there are other factors that may limit growth. In the warmer parts of Arizona the extremely dry air may call upon the plants for moisture faster than the roots can supply it and in consequence the leaves wilt and become "fired" at the tips. In the hottest parts of Arizona neither rhubarb nor horseradish will grow and the same is true of many of our common plants including the dandelion and plantain. Even corn, which farther north is reputed to love hot weather, fails to make a crop in Arizona, though freely irrigated, if planted late enough to be overtaken by the heated term with its dry air. Many of the plants of more northern regions which cannot survive in full sunlight grow very well in lath houses. The reason they cannot stand the full sun is because their leaves are not protected by an epidermis of sufficient thickness. One has but to recall the typical sun plants of the tropics to see that all of them have coarse heavy foliage from which moisture does not readily evaporate.

Stones Moved by Plants.—It is well known that plants have had a share in shaping this planet rending the rocks by means of their roots and dissolving the particles of soil by the acids they excrete, but cases in which plants actually contribute to the building of the land by carrying stones seem little known to the botanist. That this actually occurs is vouched for by Shaler who reports certain "rolling beaches" near Cape Ann to be due entirely to this action of plants. It seems that along certain coasts where the bottom consists of small stones, various sea-weeds grow, finding the stones to which they are firmly attached desirable for anchorage. When storms occur, however, the waves drag both the sea-weed and stones away from the bottom and cast them up on the beach. Here the sea-weed speedily dies, and the stones are added to the beach.

Lath Plant Houses.—Glass houses for the protection of plants during the colder parts of the year are too common to be remarkable, but houses for protecting plants from the heat of summer are still so rare in some sections as to be curiosities. A few years ago when the cultivation of Sumatra tobacco was being tried out in New England some entire farms were covered with cheese-cloth screens under which the crop was cultivated. Everybody cannot afford a greenhouse and many of those who can do not wish to be bothered with the care of one but anybody who owns a garden can have a plant house for protecting the delicate woodland species. It is built out of common laths nailed to any sort of supporting framework the laths being separated an inch or so from one another. In such a house, the early spring wildlings linger a long while after their sisters in the fields and woods are gone since they are not only protected from the boisterous winds of the early part of the year but from the hot noonday sun as well. In such a house ferns retain their delicate beauty, pansies bloom through the summer, and the bleeding heart, Dutchman's breeches, and trilliums come to a perfection seldom seen in the open.

VARIATION IN PHLOX.—*Phlox Drummondi* is a native of Texas and not very variable, so far as known, only pink, purple and red varieties existing wild. It was introduced into cultivation about seventy-five years ago. There is now a bewildering array of color varieties both with entire and with fringed petals and in the so-called star of Quedlinburg varieties the central tooth of the fringed petals is prolonged into a lobe as long or longer than the petal. In the wild form there is apparently no hint of such a character. It ought to be no difficult task to repeat the evolution of these forms under test conditions and thus get a full record of what takes place. —*Science.*

WILD AND CULTIVATED VARIETIES.—I well recall that when I first began to study plants I promptly found about a dozen species of red clover—at least they were different from each other. It took a long time to teach me that in plants there are differences and differences, some of which should be taken seriously and others ignored. In general I was taught that any differences that existed in closely related cultivated plants were to be ignored, but in wild plants they would usually have to be considered. It is really very fortunate for the cultivated plants that systematic botanists have not taken their differences seriously, otherwise we would have chaos indeed. It is unfortunate that the conservatism which most systematic botanists exhibit toward cultivated plants should not be exhibited as well toward wild plants. If more attention had been given to the cultivated plants, think what a vast host of reputed wild species would have escaped the pangs of christening. There used to be hope that after a while all the species would be described—so that systematic botanists could devote themselves to deeper studies. But, alas, it seems only necessary to make finer distinctions to reveal a wondrous display of so-called species where none was seen before.—*C. V. Piper in Science.*

CURIOUS FLOWER HABITS.—Miss Nell McMurray notes that *Medeola Virginiana* has a habit of holding its flower buds and fruit above the upper whorl of leaves, while the blooming flower never fails to hang its head beneath them. To this it may be added that the same habit runs through the *Trillium* family, to which *Medeola* is a close ally. *Trillium cernuum* is named from this habit and so is *T. declinatum* while the name of *T. erectum* would indicate the exact reverse of this condition it is a matter of ordinary observation that it, like the others hangs beneath the leaves. Several of the others though borne above the leaves could scarcely be called erect.

THE WILD YAM GETS A PLURAL.—Those who once thought they knew the wild yam (*Dioscorea villosa*) have another guess coming. As late as 1909 when the new "Grays' Manual" was issued there was supposed to be but a single species with possibly one variety. Even Small's "Southern Flora" which appears to have listed every plant that looked different, fails to distinguish even a variety, but a recent publication of the Government describes no less than five species and one variety. The reputed species are *glauca, quaternata, paniculata, hirticaulis* and *Floridana*. The species supposed to grow in North Eastern America is *D. paniculata*. As usual in name-tinkering the specific name *villosa* by which the plant has always been known has been thrown on the scrap heap. The root-stock of *Dioscorea* is used in medicine and it is said that there is considerable difference in the medicinal properties of the various forms. If so, we may become resigned to the splitting up of this old and familiar species in the interests of the physician when we would object to the same proceeding in the interests of the species-maker.

Improving our Wildflowers.—Now and then there is introduced into cultivation some wild-flower that is scarcely changed from the form and color it possessed in its native haunts, but since probably all plants are susceptible of greater beauty when influenced by careful cultivation, we usually find the introduced plants to be better than the originals. That all plants can be so improved appears to have been only recently understood by the great majority of plant growers. One has only to call to mind the phloxes, snap dragons, petunias, cannas, gladioluses, and dahlias that grew in grandmother's garden to realize how greatly these plants have been improved during the past few decades. These successes have caused the gardener to look for new subjects with which to experiment and we may expect great things in the future.

A Remarkable Poison.—Advertisers of patent medicines are fond of the statement that their remedies are "purely vegetable" with the added implication that this maks them quite harmless, but as a matter of fact, our most deadly poisons are products of the plant world. Among these may be mentioned hydrocyanic acid, aconite, belladonna, strychnine, and morphine, while the toxins excreted by bacteria are in some cases known to be far more deadly than the venom of the most poisonous snake. The deadliest poison of all, however, is now said to be derived from the common castor bean of our gardens and from which castor-oil is produced. The seeds have long been known to be poisonous but the poison exists in very minute quantities in single seeds. When this is obtained in a pure state its terrible death dealing power is apparent. It has been estimated that a single gramme of the poison—about as much as could be heaped on the point of a pocket knife—is enough to kill a million and a half of guinea-pigs. Another curious property of this poison is that if a dose too weak to kill is given first, the strength can be gradually increased until the subject can take, without ill effects, enough to kill ten thousand others not accustomed to it. In the blood of such immunized animals an antitoxin is formed, similar to that formed when the body is attacked by bacteria, and this antitoxin can be used to render other animals immune. It is certainly a strange thing that one of the flowering plants should possess properties so similar to those extremely simple organisms, the bacteria.

SPECIES OF HAWTHORN.—In the 6th edition of Gray's Manual exactly ten species of our native hawthorns (*Crataegas*) are given for the North Eastern States, but Edward L. Greene asserts that there are a thousand species in this region and the last edition of the above mentioned Manual makes some concessions toward this idea by giving a list of sixty-five forms which it recognizes as valid species. It is certain, however, that there are not even sixty-five species in the sense that the older botanists recognized species, for they were quite familiar with the plants of the region and would have been sure to name at least the major part of the number indicated. The fact is the modern race of botanists has not succeeded in discovering new species in places familiar to the plant collectors of former days. What it has done is simply to put together a new definition of species which will enable it to name the varieties of the older botanists in a new category. Under these conditions, it will not be surprising to find new species being described in any genus. All that is necessary is to make your distinctions fine enough and a crop of new species is the inevitable result. This has been so in *Antennaria, Sisyrinchium, Panicum, Viola* and many others, and the only reason that every genus has not similarly expanded is because no botanical segregator has attacked them. At the same time, the varieties of lettuce, cabbage, radish and other vegetables produced by the gardener are regarded as not worth attention from a true scientist. Nevertheless the only difference between the more recent species of the botanist and the new "creations" of the gardener is that one is the product of natural selection alone and the other of natural selection aided by the art of the cultivator. One may be useless, the other never is. In making this distinction between the useful and useless, the species-maker is scarcely in an enviable position, but it is doubtless far better for him to busy himself with useless things than to interfere in things of more value.

Root Tubercles.—That practically all species of the Leguminosae or pea family have small modules on their roots inhabited by bacteria, is well known. These bacteria have formed a sort of partnership with the higher plant and in exchange for certain plant foods which they receive, take the free nitrogen out of the air and turn it over to their partner. In this manner the legumes are able to grow in soils deficient in nitrogen, and thus find a favorable habitat in regions where other plants have difficulty in existing. While other plants, so far as known, do not have the co-operation of these helpful bacteria, many have arrangements "just as good." For instance, a large number of our forest trees have mycorhiza on their roots. These are essentially fungus strands that inhabit the outer layers of cells in the roots and act somewhat after the manner of root hairs in other plants. A few other plants develop "root-tubercles." These in appearance are much like the nodules that appear on the roots of the legumes only larger, and anyone who cares to see them may do so by digging up the nearest plant of New Jersey tea (*Ceanothus*). These are inhabited by a fungus, which has the reputation of getting nitrogen from the air like the clover bacteria and this seems borne out by the fact that plants with these root tubercles can live in regions almost as forbidding as can the legumes. Some whole families of plants seem equipped with these tubercles, among which may be mentioned the various species of *Ceanothus*, the alders, the bayberries (*Myrica*) and the buffalo berries (*Shepherdia*) and *Elaeagnus*.

LEAVES ON FRUITS.—A correspondent mentions finding a large berry of *Mitchella repens* with a tiny, perfect leaf growing on either side of its two eyes and asks if sprouting seeds sent out the leaves from miniature plants. This curious occurrence is not due to sprouting seeds, as surmised but is a natural abnormality if one may so express it; that is, it is an occurrence quite in line with the laws of plant structure. In the partridge berry (*Mitchella*) the twin flowers are borne upon a compound fruit which must consist not only of the ovary but part of the flower stalk as well. A flower, or flower cluster either, for that matter, is essentially a transformed branch; so the leaves, which normally grow from branches, are not out of place when appearing on such fruits though nature rarely makes such disposition of them.

MYTHOLOGY AND THE DAY LILIES.—If there is a group of plants anywhere that is better known under its generic name than that of the *Funkias* or day lilies, that group does not come to mind as we write. They are natives of China, Japan and Eastern Siberia but for more than a hundred years have been familiar garden plants in Europe and America. There is scarcely an old fashioned garden in the North Temperate zone without its clump of plantain or day lilies. In the early days of plant study several attempts to attach different names to the group were made but the nomenclature soon settled down to *Funkia* and thus the plants have since borne. But well-settled names are nothing to the name-tinker, if there is a chance to substitute for them "something just as good," hence we find an officer of the New York Botanical Garden proposing in a recent number of *Torreya* that this group of plants hereafter be called *Niobe.* It seems that a botanist named Salisbury suggested this latter name for the plants just 99 years ago, while *Funkia* was not proposed until five years later. For some unknown reason *Funkia* was adopted instead of *Niobe* and one would naturally think that after using it for nearly a century there could be no very great need of a change. In Mythology, it will be remembered, Niobe was the daughter of the unfortunate Tantalus who was doomed forever to forego his most cherished desires. How appropriate it would be for gardeners and botanists generally to turn our name-tinker into a modern Tantalus be refusing absolutely to adopt his new name!

Government Seeds.—About this time of the year the majority of voters have their attention called to the approaching season for gardening by the appearance in their mail of packets of common garden and flower seeds sent under the frank of their congressman. This pleasant method of reminding voters that their representative is still in existence and hopes for another election some time in the future, costs the national government much money annually, and while the average gardener prefers to buy good seeds from reliable seedsmen, our congressmen would feel lost without this time honered sop to their constituents. In 1910 more than sixty million packets of seeds were sent out, about eleven million being flower seeds. Each senator and member of congress receives twenty thousand packets of vegetable seeds and two thousand packets of flower seeds. According to *Plant World* one member of congress sent out seven times as many packets as there were men, women and children in his district. The government annually sends out many meritorious plants and seeds to those who can use them, but these are not to be confused with the seed distribution of congress.

SCHOOL BOTANY

Agricultural Schools.—As a nation we are fast getting over the idea that anybody can succeed at farming. The business of getting the most out of the soil in the way of crops, is now known to be a matter of much science, and high schools, colleges and universities are rapidly adding agriculture to the list of courses. In 1908 there were 545 institutions giving such courses, but in the past two years the number has nearly doubled being now 875. Thirty-eight high schools have already introduced agricultural courses and the next few years seem destined to see many more such institutions give attention to this subject.

Information Versus Thought.—How do you yourself stand on this question? Is your idea of a good student, that of a good "receptacle?" Do you regard your instructors as useful grain-hoppers whose duty it is to gather kernels of wisdow from all sources and direct them into your receptive mind? Are you content to be a sort of psychic *Sacculina,* a vegetative animal, your mind a vast sack of two apertures, one for the incurrent and the other for the outcurrent of predigested ideas? If so, all your mental organs of combat and locomotion will atrophy. Do you put your faith in reading or in book knowledge? If so, you should know that not a five foot shelf of books nor even the ardent reading of a fifty foot shelf aided by a prodigious memory will give you that enviable thing called culture because the yard-stick of this precious quality is not what you take in, but what you give out and this, from the subtile chemistry of your brain, must have passed through a mental metabolism of your own so that you have lent something to it. To be a man of culture you need not be a man of creative power because such men are few, they are born and not made; but you must be a man of some degree of centrifugal force, of individuality, of critical opinion, who must make over what is read into conversation and into life.—*Dr. H. F. Osborn in Science.*

THE SCIENTIFIC BENT.—The man who is born to zeal for experiment or observation can not be put down. He is always at it. Somewhere or somehow he will come to his own. No man ever adds much to the sum of human knowledge because the road is made easy for him. Leisure, salary, libraries, apparatus, problems, appreciation—none of these will make an investigator out of a man who is willing to be anything else. There is human nature among scientific men, and human nature is prone to follow the lines of least resistance. It takes orginality, enthusiasm, abounding life, to turn any man from what is easily known to that which is knowable only through the sweat of the intellect.—*David Star Jordan in Science.*

RESEARCH WORK AND THE TEACHER.—Our science courses are still very imperfectly adapted to their constituencies, and we need a study of the reasons and remedies therefor. We have great need for a discovery of better ways of presenting and demonstrating important matters, for more effective and simpler experiments, for more illustrative methods and materials. Again, the extreme specialization of modern science and the consequent inaccessibility of most of its new results to general users of knowledge make vastly valuable the preparation and publication of such expositions of important botanical subjects as combine literary elegance, pedagogical force and scientific accuracy; and the teacher who does this work well comes very close to the investigator. The community needs not only the discoverers of new knowledge whose best environment is the university, but also the interpreters of knowledge whose environment is the college. Again there is a great field for original study in the investigation of local floras from the natural history standpoint. The construction of a local flora in which the plants are not simply listed but also described ecologically, while the whole subject is presented in attractive literary from, would not only realize for the teacher the real value of abstract investigation but it would constitute a work of marked scientific value while fitting perfectly with the work of teaching.—*W. F. Ganong in The Teaching Botanist.*

The Early Naturalists.—These men of the old school were lovers of nature. They knew nature as a whole, rather than as a fragment or a succession of fragments. They were not made in Germany or anywhere else and their work was done because they loved it, because the impulse within would not let them do otherwise than work, and their training, partly their own, partly responsible to their source of inspiration, was made to fit their own purposes. If these men went to Germany as many of them did, it was for inspiration, not for direction; not to sit through lectures, not to dig in some far-off corner of knwledge, not to stand through a doctor's examination in a dress coat with a major and two minors, not to be encouraged *magna cum laude* to undertake a scientific career. The career was fixed by heredity and early environment. Nothing could head them off and they took orders from no one as to what they should, or what they should not reach as conclusions. They did not work for a career—many of them found none—but for the love of the work. They were filled with a rampant, exurberant individuality which took them wherever they pleased to go. They followed no set fashions in biology. Such methods as they had were their own, wrought out by their own strength. They were dependent on neither libraries nor equipment though they struggled for both. Not facilities for work, but endeavor to work, if need be without facilities, gave them strength and their strength was the strength of ten.—*David Starr Jordan in Science.*

First Hand Knowledge.—If you purpose to be a naturalist, get as soon as you can at the objects themselves; if you would be an artist, go to your models; if a writer, take your authors at first hand and after you have wrestled with the texts and reached the full length of your own fathom line, then take the fathom line of the critic and reviewer. Do not trust to mental peptones. Carry the independent, iniquisitive, sceptical and even the rebellious spirit of the graduate school well down into undergraduate life and even into school life. If you are a student, force yourself to think independently; if a teacher compel your youths to express their own minds. In listening to a lecture, weigh the evidence as presented, cultivate a polite scepticism, not affected but genuine, keep a running fire of interrogation points in your mind and you will finally develop a mind of your own. Do not climb that mountain of learning in the hope that when you reach the summit you will be able to think for yourself; think for yourself while you are climbing.—*Dr. H. F. Osborn in Science.*

EDITORIAL

The consideration of a new postal bill which among other things proposes to raise the mailing rates on magazines has caused considerable anger, anxiety and excitement among publishers generally during the past few weeks. At present the immediate danger seems averted, but still threatened. If the postoffice department was to be judged solely by its effects upon publishers one would be forced to conclude that its object is to bother them as much as possible. Several recent rulings have been of the kind called class legislation, wherein rules have been made that effects only part of the publications. Thus the ruling that publications sent to subscribers in arrears must pay a higher rate of postage on such copies was not applied to all alike. Monthlies and quarterlies can extend the time of delinquents only a few months, others have a year in which their subscribers may pay up, and while a majority of publishers now stop subscriptions as soon as they expire, this ruling of the government is, in effect, an attempt to tell publishers how long they may extend credit to their patrons. If an old subscriber goes to Europe for a holiday and forgets to pay for the magazine before departing, the publisher must cut him off the list or pay more postage on such copies; if he falls ill and is unable to attend to renewals, no consideration may be shown him. How this proposition works out is shown by the report for the last postal year, where four thousand two hundred and twenty-nine publications are reported to have died in a single year. Indeed many of these never had a fair start for more than eleven thousand were denied the second class privilege in the past decade. Should congress pass the proposed law increasing the rate of postage, magazines generally will simply raise the subscription price to their readers. The proposed law therefore threatens every one who subscribes for the magazines. Readers are therefore urged to watch legislation of this kind and to protest to their senators and congressmen when hostile action threatens.

BOOKS AND WRITERS.

Readers of this magazine who have followed Dr. W. W. Bailey in his entertaining articles on plants, may have guessed from the manner of treatment that the author is a poet, and such proves to be the case. But those of us who have known of Dr. Bailey's facility in verse-making for many years were nevertheless surprised at the versatility displayed in the handsome volume entitled "Poems" that appeared from the press of the Preston and Rounds Company last year. About half the book consists of occasional poems read at various gatherings of his college fraternity and therefore not of general interest, though it is understood that the desire to have these poems in convenient form was the main reason for the appearance of the book. The interest of the botanical student in the book will center in the nearly fifty poems on various phases of nature, and in the additional poems of sentiment and childhood which compose the volume. Dr. Bailey's favorite flowers are here "embalmed in verse" as some other poet has said. Glancing through the list of titles we find the houstonia, bloodroot, anemone, painted cup, gentian and other common but inspiring flowers; in fact Dr. Bailey seldom goes far from home for his subjects, having that enviable quality of being able to find interest in even common things. Only a small edition of the book was printed, and those who hope to get a copy should lose no time in ordering.

Any teacher of botany who cannot get his money's worth out of Ganong's "The Teaching Botanist" must be a peculiar individual. For ten years or more the book has been a strong inspiration toward a better presentation of the subject of botany and the new second edition which has recently appeared will but emphasize this point of view. Not that the reviewer expects all teachers to agree with everything in the book; there are a good many things that teachers who think for themselves may have a different opinion about and the reviewer himself dissents here and there but the subject is handled in such a common sense way and is so lacking in a spirit of dictation that the few faults are not conspicuous. In the list of publications, an important botanical magazine is not named nor is Howell's volume on the "Flora of North West America." In our opinion a good many improvements could be made in the course of study outlined. We would not defer a study of cells until seeds, roots, buds, and stems had been studied, nor would we use horse-beans and morning glory seeds, while so much better material is to be had. In the outline for the spore-plants, the "type study" method is still in evidence though this is fast giving way elsewhere to a study of evolution as illustrated by various species from algae to pines. In the endeavor to make the book a practical monograph on the teaching of botany, the second edition has been greatly extended and contains nearly two hundred pages more than the first edition. Notwithstanding this it sells for the same price —$1.25 net. It is published by the Macmillan Co.

A second revised edition of Vinal's "Laboratory and Field Studies in Botany" has recently appeared from the press of P. Blakiston's Son & Co., of Philadelphia. This is designed largely for the analysis of flowers such as still persists in parts of New England as an echo of the old courses in botany built upon Gray's series of text books. While the reviewer fails to find much of value in such a course, he must add that the blanks for this purpose in the book under discussion are both handy and complete. The most valuable feature is found in the questions on seeds, roots, leaves and the like that are designed to prepare the student for work in analyzing flowers. These are quite suggestive and founded upon right methods, requiring the pupil to think for himself. The book is bound in paper and costs 60 cents net.

The average man, if he thinks of the subject at all, is likely to class the landscape gardener with the man who sods the lawn or spades up the back garden, but appreciative folk know him as an artist who paints his pictures with trees, bushes and flowers on a canvas of broad sweeping greensward. Such a man points to great public parks or less pretentious though no less beautiful private places as evidences of his skill and his name is associated with the work exactly as is the name of the architect with some magnificent building. In "Landscape Gardening Studies" recently issued by the John Lane Company, New York, the author, Samuel Parsons describes some twenty masterpieces of his own, among them the rehabilitation of Central Park, New York, a seaside park at Coney Island, the Russell Sage home at Sag Harbor, and the colonial gardens at Van Cortland Park, New York. There are also plans for cemeteries, playgrounds, private estates, school grounds and other plantings. In discussing each feature of these plans the author explains all the operations needed to bring them to perfection, and those studying or practicing this difficult art will find many helpful suggestions in the book. It is published at $2.00 net., postage 10 cents.

A British book by Harold C. Long on the "Common Weeds of Farm and Garden" will make interesting reading on this side of the Atlantic not only for the individuals who take the principal parts in the "Controversy with Weeds" as the author humorously dubs agriculture, but for botanists as well. An excursion through the book shows that British and American weeds are pretty much alike as we can well understand, since we caught most of our noxious species from Europe; in fact, a careful examination fails to locate a single native American among the bad weeds of Great Britain. Evidently the struggle for place among the foreign species is too strenuous to permit the fighters among our natives to get a footing. There are more than four hundred pages in the book and every phase of the weed nuisance is thoroughly discussed. There are chapters on the way weeds are spread, and general preventive measures given after which the plants are taken up under such heads as weeds of arable land, improvement of grassland and poisonous plants. The plants are described and the measures likely to eradicate them indicated. With us in America, some of the latter would doubtless be disregarded if we found some of the weeds in our fields; for instance the red poppy, fox glove, heather, pansy, and adder's-tongue fern are included with the weeds. The very thorough way in which the subject is handled will make this book a very useful one to anybody with weeds to fight. It is issued by the F. A. Stokes Co., New York.

Messrs. Ginn & Co., have recently issued "Domesticated Animals and Plants" by Davenport; the D. Van Nostrand Company announce "Ancient Plants" by M. C. Stopes; Stokes have published "Gardens Near the Sea" by Lounsberry; and the Sturgis and Walton Company have issued "Children's Gardens for Pleasure, Health and Education."

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MAY, 1911

The AMERICAN BOTANIST

Devoted to Economic and Ecological Botany

CONTENTS

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THE SOAPWEED.—*Yucca glauca*

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In all fair hues from white to mingled rose,
Along the hedge the clasping bindweed flowers;
And when one chalice shuts a new one blows,
There's blooming for all minutes of all hours,
Along the hedge beside the trodden lane.
Where day by day we pass and pass again.
—Augusta Webster

THE SOAP WEED.

BY EARL LYND JOHNSTON.

IT is the unusual that attracts our atention. The common things of life, no matter however interesting they might be, are likely to be overlooked every day. An ever-green tree in a never-green environment, our western plains, would call forth comment from a very ordinary person. It is an unusually interesting plant that forms the subject of this article.

As the early explorers passed through Colorado they noticed a plant out of harmony with its surroundings. It could be seen on the dry hills and rocky slopes, and, perchance, in the sandy river bottoms. It was green while its environment was bleak and dry. Fremont, in the report of his trip down the Platte, made mention of it. Early settlers became acquainted with it and knew its name long before they had even heard of the names of the other plants indigenous to the same region.

It presents a striking appearance with its long, stiff, evergreen leaves, pointed like daggers, growing in a dense bunch from a thick root. The appearance of these leaves gave it the name, "Spanish bayonet." However, locally I find this name rather unknown. "Soap weed," the name given to it by the Indians, is the name by which it is known here.

Yuccas are so familiar, being cultivated in many eastern flower gardens and parks, that the general characterstics will not be of a great deal of common interest. Yet, for the sake of the few who have never seen them I shall tell of yuccas as I have begun to know them on the plains of Colorado.

They belong to the Liliaceae and number, according to some authors, about twenty species. Our species is known as *Yucca glauca* Nutt. Although some are tree like plants ours is stemless with the leaves growing in dense bunches from a long, tough, thick root. The leaves remain green throughout the year and have a sort of varnish covering to prevent the escape of moisture. They are two to three feet long, very stiff and tipped with a spine which is supposed to protect the plant. They are quite narrow, scarcely an inch wide and have coarse white filaments along the margins which look and feel not unlike the sisal fiber used in the twine of that name. The fiber of some of the species of the Southwest is used by the Indians as cordage.

The white, bell-shaped flowers growing on a flower stalk, two or three feet high, are truly a glorious spectacle. This scape arises from the center of the bunch of leaves, and has the flowers arranged on it in rows, drooping like tiny bells with clapper-like stigmas ready to tinkle in the breeze. Their creamy whiteness standing out against the unvaried vista of the plains always compels one to stop and admire. The flowers are fleshy, and so hard to dry that I have never succeeded in getting a good specimen for my herbarium. It is said that cattle grazing on the plains are fond of them, hence, its stockade of pointed leaves is supposed to prevent this, but, I seriously question this supposition. The leaves seldom extend more than three feet from the root and considerably less than at a right angle to it. The racemes are so far above them that cattle can easily get to the bloom. I have been told by cattlemen that when cattle do get to them their milk tastes soapy. What seems to me to be another fallacy is in regarding these pointed leaves as being for the protection of the leaves themselves. Protection against what? What will eat the hard dry leaves anyway? The only thing I know that does eat them to any extent are grasshoppers and a few other insects. Prairie dogs might, but when a prairie dog can readily eat cacti what good would a single spine on the end of a leaf do if they chose to eat it?

The fruit in our species is a hard 6-celled capsule. Some southwestern species have a soft fruit which is eaten by the Indians of that region. The root has the general characteristics of xerophytic plants. It is large, woody, and porous, capable of absorbing much water in the rainy season. It is covered with a tough skin, preventing the escape, into the dry parched ground, of this stored up moisture. It is in the roots that the saponaceous properties are found.

I suppose the yucca and its method of pollination has been written about more than any other single plant, and for good reasons too. A plant that has to depend on a single species of insect for fertilization is rather unusual. I believe each species of yucca has its own species of the yucca moth, *Pronuba,* to fertilize it.

The flowers of yucca have very short anthers that cannot reach the stigmas of their respective flowers. This with the fact that the pollen is rather vascid argues against self fertilization. In addition those who have made a detailed study of yucca pollination say the pollen can not be introduced into the stigmatic tube without artificial aid. The yucca moth, in order to preserve her own progeny, comes to the rescue and saves this plant from passing into the ranks of the exterminated by pollinating it. This intelligent little creature, during the hours of nightfall, for she is noctural in her habits, gathers up a load of pollen, all she can carry, and flies to another plant where she lays her eggs within the pistil by means of her ovipositor. Here a wonder occurs. It is only when the flowers are young, generally not over two days old, that the pistils are susceptible of pollination. The moth seems to know this and never oviposits in older flowers. As soon as she deposits her eggs she goes to the top of the pistil and pushes her load of pollen as far into the tube as she can. In a few days the egg hatches and the larvae feed on the young and tender seeds. Enough seeds, however, are left to perpetuate the species.

The consideration of this plant and moth with their interdependence forms an interesting study. To see the moth at work one will have to do his observing after nightfall and with an artificial light of some kind. When one has observed a few things for himself then let him seek some good authority who has made a life study of yucca and *Pronuba*. I would refer those who wish to know more on the subject to the Third Annual Report of the Missouri Botanical Garden where they will find a long article by that profound insect authority, C. V. Riley, to which I am indebted for much information.

Ft. Lupton, Colo.

BY THE RIVER'S BRIM.

BY FRANK DOBBIN.

A WALK by the river side is always interesting as one is sure to make some interesting finds. If the stream be sluggish with plenty of mud on the bottom some of the numerous *Potamogetons* will be found or the long streamers of the eel grass (*Vallisneria spiralis*) will point the direction of the slow moving current. The submerged rocks and stones may be dark with the long stems of some moss of the genus *Fontinalis*—possibly *F. dalecarlica* or *F. Novae-Angliae*, or if it be a favorable locality the curious seaweed-like plant, the river weed (*Podestemon ceratophyllum*) may be found closely clinging to the stones where the current is swift. Generally its thick matted branches are full of particles of sand and bits of sawdust and it needs a thorough cleaning before going into the vasculum. At the first glance this plant might be taken for a cryptogam but such is not the case for a closer examination will show it to be a flowering plant. In similar places may sometimes be found the alga (*Batrachospermum moniliforme*) also clinging to the pebbles in the bed of the stream. When first removed from the water it has a jelly-like appearance but this disappears upon drying.

The sand and gravel bars running out from the bank are always good hunting ground being usually well covered with sedges—*Cyperus, Eleocharis, Scirpus* and the like; while the *Scirpus*-like rush (*Juncus scirpoides*) may often be found. On such a bar I sometimes find the small bedstraw (*Galium trifidum*) intermingled with dwarfish *Bidens*. Such places are also the favorite habitats of the sand cherry (*Prunus pumila*) which more resembles a dwarf willow than the plums and cherries to which it is allied.

If the month be August, looking up or down the stream one may catch a gleam of brilliant color. A flash of purest cardinal red which is not difficult to identify as the cardinal flower (*Lobelia cardinalis*)—the most brilliant of our northern blossoms. Where a brook enters the main stream is a favorable place to search for that more humble relative of the cardinal flower, the brook lobelia (*Lobelia Kalmii*).

On the bank and perhaps leaning out so that it is reflected in still water, will be the great St. John's-wort (*Hypericum ascyron*) a plant well worthy of cultivation for its great flowers of pure yellow. Many other St. John's-worts may be found without difficulty as they are a numerous and hardy race, liking well the neighborhood of lakes and streams.

Just outside the willows and alders that border the stream and yet out of reach of the mowing machine are sure to be found several conspicuous and easily recognized grasses. Among them being the wild rye (*Elymus Virginicus*) and the great nodding rye (*E. Canadensis*) sometimes five feet in height and having a spike ten or twelve inches in length. The genus *Bromus* and also *Panicularia* are usually well represented in such places.

The burnet (*Sanguisorba Canadensis*) with its unroselike spike of flowers though a member of the rose family is a lover of the river bank and here also the searcher after our native orchids may sometimes be rewarded by finding one or the other of the purple fringed orchids (*Habenaria grandiflora* or *H. psycodes*). I was fortunate the past summer in locating a station for the somewhat rare tubercled orchid (*Habenaria flava*) in the bed of a stream in eastern Vermont.

Space and time fail me to tell of all the finds a botanical student may make when strolling "by the river's brim."

Shushan, N. Y.

DAISIES.

By Dr. W. W. Bailey.

VERY wrong conceptions popularly prevail in regard to the daisy. In the class-room these sometimes assume a tragic form, as when the pupil with youthful temerity, seeks to name a given plant by the index of his Manual. Then, perhaps, name and description are suddenly discovered to be discrepant. The lesson, is, however, a useful one and the victim is very unlikely, unless endowed with great dullness or "cheek" to become mired again in the same puddle.

The real English daisy, the "Day's-eye" of Chaucer, the "wee crimson tipped flower" of Burns, is a modest little plant but a few inches in height, stemless and with small heads of white, pink or crimson florets. With us in America, it is only seen in cultivation either in gardens or on lawns. It makes a neat and pretty border plant.

In the United States, the plant usually known as daisy is not this *Bellis perennis,* but the ox-eye or white weed, *Chrysanthemum leucanthemum* of science. At the East it is one of the widely spread and pernicious weeds. For all that it is a "thing of beauty and a joy forever." The French marguerite or Paris daisy in some respects is like it, but is shrubby, from four to ten feet high, more delicate in aspect and hailing from the Azores. It is *Chrysanthemum frutescens.*

Then we have the daisy fleabanes of the genus *Erigeron,* looking like asters but mainly blooming earlier and with more numerous and delicate rays. The first of these to appear is early summer or late spring is robin's plantation, but the most beautiful is the Philadelphia fleabane. This is common about the White Mountain foothills and in similar locations throughout the North.

Somehow or other, the name "oxeye" has been misapplied to the cone flower (*Rudbeckia hirta*) a member of the genus to which the parent of the too familiar "golden glow" belongs. These are in no sense daisies, but apart from names, or may be in despite of them, they are among our showiest wildflowers. Cone flower is said to have migrated from the West with hayseed and is steadily extending its range. It has coarse hairy stems and foliage and large orange-colored heads with chocolate cone or disk. It is splendid in cultivation, ever increasing in size, while in meadows as one views it from car windows it spreads a gorgeous and unsurpassed carpet.

This plant will illustrate the use of the word weed. A weed is a plant that grows out of place, where not desired or needed or where it is a positive nuisance. It follows that the same plant may be a weed or flower, in the familiar sense, according to situation or environment. In the field the "black-eyed Susans" are weeds to fight; in the garden they are effective flowers to cherish.

The little Mayweeds, of the genus *Anthemis* or *Maruta* may also be called daisies. They are very closely allied to the oxeye and have a pretty sleep habit, when as twilight approaches, they turn down their white rays. They love to hang about old yards and garden paths and really make a handsome bouquet for the indoor vase but their rank chamomile odor is rather against them. The field chamomile is not so offensive and its lavender rays project straight out from the disk.

Providence, R. I.

PROLIFERATION IN A PEACH BLOSSOM.

BY A. E. SHIRLING.

A PECULIAR case of proliferation in a peach blossom was brought about by an accident to the growing shoot of a budded seedling. In August, I budded a seedling

ABNORMAL PEACH BLOSSOM

peach in my yard. The next spring, the usual method was followed of cutting off the top of the seedling down to the bud. The bud grew but was accidentally broken off when about three inches long. The bud that had been inserted, however, was a multiple bud, having a flower bud on either side of the leaf bud that first grew. After the destruction of this first shoot, the flower buds were stimulated to exert themselves to see what they could do to repair the loss of the leafy stem; but they were up against a difficult proposition; for being merely flower buds, with floral organs already present in embryo, they could not entirely change their nature. The attempt, however, was interesting. One of them opened and developed sepals that grew abnormally, becoming almost as large as ordinary peach leaves. The petals of the corolla were shrunken and lacked their normal bright color. The pistil grew into a twisted, dwarfed shoot, while the stamens were abortive. Moreover, the peduncle grew till it was many times normal length.

Kansas City, Mo.

POLLEN GRAINS.

MYRIADS, countless teeming myriads, of pollen grains, infinitesimally small in size, extremely delicate of texture, color and shape are formed and, for the most part, lie hidden in the secret recesses of the simple and often despised, or the more beautiful and attractive, blossoms with which Nature paints our world with glory. To the naked eye they pass unnoticed; with the microscope they will show their loveliness and individual strangeness of form both of which are so great that one stands charmed and well nigh spellbound before them. Here are tiny structures most wonderfully made, created to carry out the most important functions namely the fertilization of their own plant species and consequent propagation of their kind. They are formed within the stamen anthers, mature and die unseen; yet on their brief but essential life's work we depend for much that is exquisite, refreshing, useful and necessary in the plant world.

It is when the grains are considered individually, those known to be wind wafted and those borne by insect agency that we begin to realize their wonder. It is very essential that there should be some means by which a wind carried grain should easily *catch* the wind and we find in numbers and numbers of instances that such grains often possess many sides and angles. In form they are triangular, square, polyhedral, hexagonal, octagonal, cubical, filiform cylindrical, etc. So, too, it is extremely light in weight, very thin coated, very smooth surfaced and very dry and powdery. On the other hand, insect borne grains are usually circular, oval, ellipsoid, etc. in form, their coats are marvelously grooved, warted, pitted, furrowed, ridged or covered with most exquisite spinous projections or excrescences. They are often extremely mucilaginous, owing to wee drops of oil that are secreted, this oil varying in color from cream to yellow and other richer hues. Many grains are pearly white, shell pink, cream, very pale green, lemon yellow, orange, rich red (as in some of the mulleins), deep purple (in arbor vitae), almost black (some tulips), blue (*Scilla*), brownish black (poppy) and of many other varying tones, the commonest of all perhaps, being deep yellow.

Some very pretty and interesting examples may be seen in the following plants: In the hazel a plant in which the stamens are borne in pendulous delicate catkins, each grain is triangular with a thickened portion at each angle: in arbor vitae, another wind fertilized plant, the shape of the grain is almost exactly similar though the coloring is different the latter being purple and the former yellow. In the white stitchwort the "dairy maids" of our spring hedgerows the grain is hexagonal, yellow and very rough coated. In mallow it is circular, having its outer coat (extine) studded over with most exquisite delicate spinous projections and of a deep brownish yellow color. Very choice examples of spinous surfaced grains can be seen in many of the compositae for instance, oxeye daisy, purple erigeron, common daisy, the large white "moon" of our gardens, the marigolds, dandelion, etc., and in the French honeysuckle, *Campanulas* and countless other plant species. In the sweet scented mimosa each grain is more or less octagonal having its surface covered with furrows and intricate striations. In the chickory we find polyhedral grains, in the beech, oblong and deeply grooved ones, in the plantain they are quite circular, smooth surfaced and pearly white. In the lesser celandine they are circular, yellow in color, having here and there on their extines small knob-like projections. The garden lupine shows a pretty example: in this plant each grain is brick-shaped, somewhat rounded at both ends, rather rough surfaced of a fair size and rich orange in color, and in the stinging nettle we find them quite circular in form, very smooth, grayish white in hue and very small. It is interesting to take in one's fingers a small branch of nettle blossoms and hold it up against a dark object: if the stamens are ripe, that is, are ready to dehisce and shed their pollen the grains may be seen forcibly ejected every now and then just like puffs of smoke. When this happens in the open air, of course the wind catches the dry powdery grains as they are thrown off from the somewhat pendulous sprays and carries them to some other flower on the same or a neighboring plant. In the cycads, firs, etc., all of them wind fertilized plants, the grains of pollen are made specially buoyant by reason of their possessing two very small bladderlike pouches or hollow vescicles which act like sails.

In all the flowering plants of field down, and hedgerow, copse, woodland, river and swamp, can these lovely grains of pollen dust be found—perfect little structures, each with two coats surrounding a mass of coarse grandular protoplasm, the life-giving element of all cells with its nucleus and grains of starch, certain fatty matters and tiny drops of oil, all of which material enables the grain to perform its functions of fertilization, once it has escaped from the anther and alighted on the pistil of some plant of the same species. Then it is that the grain sends out a little tube which grows down the pistil till the ovary is reached and the contents of the grain mingles with one of the ovules in the ovary, thus bringing about fertilization which in time will cause the ovule to become a ripe seed. In some plants, as in crocus this is accomplished in a few hours; in some plants a few weeks elapse; in the orchids, several months pass; while in the firs and their allies two years pass before development is complete. The work goes on, we cannot see it, but we can see the stamens as they sway versatile in the tiger lily, stand rect, column like, pearly pink or creamy white in the mallow or in countless other positions in all kinds of flowering plants and we can see the grains beneath the miscroscope and there revel in their many beauties. Perhaps of all the floral structures these wee bodies are some of the most marvelous. Certain it is that for the important issues of life for which they were created they are most delicately, most chastely made.—*K. E. Styan in Selborne Magazine.*

THE SPRING FLOWERING WITCH HAZEL.

I WAS pleased to see in *The American Botanist* a reference to the American Spring-flowering *Hamamelis* and am very glad to be able to supply you with a few more particulars.

As you know, the only other *Hamamelis* native of this continent is *H. Virginiana* which flowers in the fall and the discovery of a spring-flowering species is of much interest to botanists and those who cultivate flowering shrubs. This new species was discovered by Mr. B. F. Bush, Missouri, a gentleman who has been instrumental in introducing many good shrubs. Plants were first sent by him to the Arnold Arboretum in October, 1908. Mr. Bush found this witch hazel in the mountains of North Carolina.

At the date of writing (April 4) it is just in full bloom at the Arboretum, quite small plants being well covered, and though not so showy as the Japanese or Chinese species yet it is an exceedingly interesting and desirable addition to our early spring flowering shrubs. The flowers have a deep red center and the petals, about half an inch in length are rich yellow suffused with red. The foliage closely resembles the Japanese *H. arborea.* In Massachusetts this new *Hamamelis* is perfectly hardy and will, I think, prove a useful addition to our gardens.

Owing to the courtesy of Professor C. S. Sargent this shrub has been growing in European gardens for the last two years, from where, I understand, you first heard of it.—*A. E. Thatcher, Arnold Arboretum, Jamaica Plain, Mass.*

[In a later communication Mr. Thatcher writes that the new witch hazel has been given the appropriate name of *Hamamelis vernale.* Mr. Charles E. A. Hale of Savannah, Georgia writes that he has found a witch hazel in full flower in his locality late in January. This is possibly the new species. A curious feature of the general region from which the new shrub comes is found in the fact that it produces several species that fruit out of season as compared with their congeners in the North. One of the grape ferns, *Botrychium biternatum,* fruits here in spring, though all its close allies, farther toward the pole do not fruit until autumn and do not, in fact, appear above the earth at all until late June or even July.—*Ed.*]

NOTE AND COMMENT

Wanted.—Short notes of interest to the general botanist are always in demand for this department. Our readers are invited to make this the place of publication for their shorter botanical items. The magazine is issued as soon as possible after the 15th of February, May, August and November.

The Water Lily a Monocot. — It has long been known that a considerable number of plants reputed to be members of the great group of dicotyledons, have many structures that seem to indicate their rather close relationship to that other branch of the flowering plant division known as the monocotyledons. In a former day these plants were ofter regarded as some of the piers of that bridge which was supposed to connect monocot and dicot and they have been much studied in consequence. Among such plants the water lilies and some of the Berberidaceae are included and Dr. J. H. Schaffner now comes forward with a re-arrangement of plant families which locate the water lilies among the monocots and pretty well toward the bottom of the list, at that, since they are sandwiched in between the water plantains and eel-grass families. It is likely, however, that most botanists will be inclined to accept this transfer and some there be who would add the mandrake (*Podophyllum*) to the same category.

Drains Clogged by Roots.—In some cities it is now unlawful to plant the so-called North Carolina poplar along the city streets because of its tendency to fill up drains and sewers with its roots. Numerous complaints of this kind have been made and most of them refer to this particular tree, but the poplar has no monopoly of such habits and a recent magazine gives an illustration of a mass of pear roots more than sixty feet long and tweleve inches in diameter taken from a tile drain which they had completely clogged. The annual layers on the single root that had caused all the mischief showed it to be only five years old and it was less than an inch in diameter where it entered the drain.

HYBRID TRAGOPOGONS.—Two species of the genus *Tragopogon* are familiar to American botanists, one the well-known oyster plant or salsify (*Tragopogon porrifolius*) with purplish flowers, and the other, the equally familiar goats-beard or John-go-to-bed-at-noon (*T. pratensis*) with yellow flowers. The first, usually cultivated in gardens, has occasionally run wild, the other, of no particular use, has been neglected by the gardener but is nevertheless rather the more wide spread of the two. When this vagabond of the fields meets with its aristocratic cousin of the gardens, hybridization sometimes occurs resulting in plants with smoky purple flowers and other characters intermediate between the two species. This hybrid is better known in Europe, where it is reported from both Britain and the continent and according to Focke was the first hybrid to be produced for scientific purposes, the cross having been accomplished by no less a person than Linnaeus in 1759. Those interested in hybridizing may find these two plants most excellent for experimental purposes.

ORIENTATION OF FIBROUS ROOTS.—According to *Horticulture* an ingenius Jap has discovered that the small roots of turnips, beets, radishes, carrots and the like grow in two straight lines on each side of the main root, and that further these roots always grow in east and west directions, never north and south. All that is necessary, then is to arrange our gardens and plantings so that these roots will be able to grow out into the soil between the rows and thus secure the plant food where it is most accessible. Most gardening works suggest that plants do best when planted in north and south rows but this is reputed to be because the roots of the plants are in this way shaded from the sun and not so easily dried up. Can it be that the Jap has really hit upon the real reason, or is this only another of those superstitions to which those who delve in the soil are so often addicted. At any rate, any of us with a garden should be able to either prove or disprove the proposition this summer.

THE SOAP NUT.—In a recent number of the *Scientific American* E. Moulie, Jacksonville, Florida, has an account of a wonderful soap-bearing tree said to have originated from seeds brought from China by missionaries twenty-seven years ago. Mr. Moulie believes that the soap-nut industry may be made to pay in Florida and the warmer parts of the South and offers seeds free to those who wish to experiment in the matter. The botanical relationships of the soap-nut are not indicated but in this connection it may be noted that soap-trees are not unknown, even in this country. In fact, we have two native species one of which *Sapindus acuminata,* grows as far north as Arkansas. Many other soap trees belong to the genus *Sapindus. Sapindus utilis* has long been cultivated in Northern Africa for its soapy qualities, and the Chinese have another species, *S. mucorossi* valued in the same way. It is possible this latter species that has found favor in Florida. Still another species *S. saponaria* grows wild in the American tropics.

BIRDS AS BOTANISTS.—If anyone whose winter rambles lead him along wet wood borders will take note of clumps of *Panicum clandestium* he will find the upper sheaths split to shreds while still uninjured at the junction with the dry yellow blade above. A few winters ago the cause of this was made known to the writer when watching a flock of chickadees near Takoma Park, a suburb of Washington, D. C. These animated balls of gray and black were having a feast on the big fat grains of the cleistogamous spikelets concealed in the sheaths. I have since found occasional clumps of *Panicum Boscii* also with shredded upper sheaths. Evidently the chickadees knew of this character of *P. clandestinum* and profited by it before Linnaeus bestowed the name "clandestinum" on the species because of it.—*Agnes Chase in Rhodora.*

Rubber from the Milkweed.—Several familes of plants, including the dogbanes (*Apocynaceae*) the spurges (*Euphorbiaceae*) and the milkweeds (*Asclepiadaceae*) pretty generally possess a milky juice called latex. In many instances this latex contains rubber, and a large share of the commercial product comes from tropical trees and vines belonging to these families. Even some of our temperate region plants produces rubber but this is usually of such inferior quality and occurs in such minute quantities that it is never likely to appear in market. The fact that the rubber exists, however, is of interest. Recently some investigations have been carried on with the common milkweed (*Asclepias syriaca*) and a note in the *Ohio Naturalist* records that it is a rubber producer though the rubber is not of a high grade. Besides the rubber, the latex from this plant contains sugar, mineral matter and resin. About 2 or 3 per cent of rubber is yielded by the latex.

Meaning of Amaryllis.—A subscriber asks for the meaning of the name *Amaryllis* which is sometimes applied to a group of tropical American bulbous plants allied to the iris and narcissus. The same group is also known as *Zephyranthes* and *Atamasco* but usually amaryllis is added as a common name showing that the plants became well known under the generic name of *Amaryllis* before the name-tinker got busy with them. *Amaryllis* is a Latin word and its equivalent is found in the Greek language, but there seems to be no meaning connected with this word that would make it applicable to these plants. A safer guess is that the plants were named for the Spanish word *Amarilla* meaning yellow. These plants abound in Mexico and other countries in which Spanish is spoken and it is quite likely that species with yellow flowers sent to Linnaeus as amarilla lilies induced him to give the name of *Amaryllis* to the genus. The fact that several species have yellow or yellowish flowers gives color to the suggestion. If any reader can throw additional light upon this subject we shall be glad to hear from him.

Effects of Moisture on Wood.—The effect of water in softening organic tissue, as in wetting a piece of paper or a sponge, is well known, and so is the stiffening effect of drying. The same law applies to wood. By different methods of seasoning two pieces of the same stick may be given very different degrees of strength. Wood in its green state contains moisture in the pores of the cells, like honey in a comb, and also in the substance of the cell walls. As seasoning begins the moisture in the pores is first evaporated. This lessens the weight of the wood but does not affect its strength. It is not until the moisture in the substance of the cell walls is drawn upon that the strength of the wood begins to increase. Scientifically this point is known as the "fiber-saturation point." From this condition to that of absolute dryness the gain in the strength of wood is somewhat remarkable. In the case of spruce the strength is multiplied four times; indeed, spruce, in small sizes, thoroughly dried in an oven is as strong, weight for weight as steel. Even after the reabsorption of moisture when the wood is again exposed to the air the strength of the sticks is still from 50 to 150 per cent greater than when it was green. When, in drying, the fibre-saturation point is passed, the strength of wood increases as drying progresses, in accordance with a definite law and this law can be used to calculate from the strength of a stick at one degree of moisture what its strength will be at any other degree.—*Forest Leaves.*

A VIOLET LACKING PETIOLES.—Last May I found a group of scattered clusters of unusual violets, growing near the downy violet (*Viola pubescens*), which they closely resemble, the leaves, only, differing. To me, a violet leaf without a petiole is unique. The downy violet sports a well developed petiole and the freak lacks it. The blade of the freak leaf is narrower than that of the downy. Apparently the petiole has vanished and the stipules are leaving. Traces of the latter are found at the base of the blade, where they are mostly grown fast. The color is paler, the texture thinner, the margin more finely cut and, sometimes, the tip of the deserting stipule remains. The midrib has a kink near its base and the leaves either turn up or down on the stem. One feels like calling it a degenerating downy violet.—*N. McMurray.* [All such strange freaks are worth recording and cultivating. Often sowing the seeds from such plants will bring more of the same form. We trust that our correspondent will keep this plant under notice and find time to experiment with it.—ED.]

WHITE PARTRIDGE BERRIES.—There is one thing that may be presaged of all species of plants bearing red fruits: if we search long enough, we are reasonably certain of finding white and yellow forms.The yellow forms are due to a diminution of the anthocyan that gives the red color; in fact, even black fruits are often caused by an over load of this substance. It will thus be seen that there is an easy transition from black fruits to red ones as in the choke-berry (*Pyrus*) or from red fruits to yellow ones as frequently occur in the holly and mountain ash. White berried forms are albinos such as may also be found in the animal kingdom and are due to a lack of pigment. They may thus be expected to occur in any part of the plant having colors other than green. White forms of the partridge berry (*Mitchella repens*) have been frequently reported, possibly because they are so widely distributed. The form has been known for thirty years or more but in *Rhodora* for February C. H. Bissell gives the name of *leucocarpa* to it and describes it as a "new form." Bissell's specimens are from Connecticut but others are known from Massachusetts, New Hampshire, New York and Pennsylvania. We would be glad to hear of other stations.

FREEZING POINT OF ORANGES.—It is generally known that pure water will freeze at a higher temperature than water with various substances in it, and plant juices have been found to be no exception to this rule. Some experiments carried on at Rollins College with oranges and grape fruit showed that the juice of the ordinary orange needs be cooled down to about 22 degrees before it will freeze while the freezing point for both the grape fruit and tangerine is below 23 degrees. In these experiments the juice was extracted from the fruits and strained before freezing. It is well to remember, however, that it is not always the freezing that kills plants, for the protoplasm of many plants can endure temperatures many degrees below zero unharmed. On the other hand some plants cannot stand a temperature several degrees above freezing. It all depends upon the constitution of the particular species.

THE SOUTHERN WAHOO.—Our southern variety of strawberry bush (*Euonymus Americanus*) known by us as Wahoo, seems to be of much more slender growth than the northern burning bush. Its habit of growing on stream banks makes it reach up often 4 to 6 feet high and so slim as to look vine-like, its green color adding to the similarity. Not only are its "four-sided branchlets" deep green, but the color often extends almost to the ground. Its pods are larger than the smooth ones of the burning bush, are decidedly rough and well colored—crimson—while its thread-like peduncles and the waxy covering of the seeds are bright scarlet. The pods open from three quarters to an inch in width and the seeds are dropping now, in November, most of the lower pods being empty. It is a very pretty bush, in leaf, flower, pod, seed and stem, and is easily cultivated.—*F. G. Kenesson, Remlig, Texas.*

Waste in Lumbering.—According to a recent publication of the United States Forest Service we are still wasting our forest products though well aware that the supply will soon run short. If all the wood wasted in the manufacture of yellow pine lumber, in 1907 had been steam distilled for wood turpentine it would have yielded more than the total production of gum turpentine for that year. If all the waste spruce, hemlock, poplar and cotton-wood in that year had been used for paper making it would have furnished all the paper used in the same time. The wood that went to waste in manufacturing chestnut lumber, if used to make tanning extract would have produced twice as much as was produced by the chestnut cordwood used for that purpose. The waste in the manufacture of beech, birch and maple in 1907 was nearly equal to the quantity of these woods used for distillation while the wasted oak for the same time was twice as much as all the hardwoods used for distillation. Evidently the lumberman needs educating or else investigating.

Relatives of the Sumach.—In most parts of our country the sumach family (*Anacardiaceae*) is not of much economic value. A few species are planted in extensive grounds for the tropical appearance given by their long pinnate leaves, but others such as the poison ivy and poison sumach, though equally decorative have to be ruled out because of their harmful qualities. A large number of the sumach's allies in other parts of the world are more or less under suspicion but others are among our most decorative species and the fruits of several are edible. The pepper tree (*Schinus mollis*) so largely planted in California is a member of this family and the famous tropical fruit the mango (*Mangifer Indica*) is another. The cashew nut (*Anacardium occidentale*) also belongs to the sumach family. In flower and fruit, all these species resemble our common sumach in a general way, having clusters of fruit each of which contains a single seed, but here the resemblance ceases for the tropical fruits are larger than peaches.

FORESTS AND WATER-FLOW.—The influence of forest cover on water-flow is of a three fold nature: (1) the mechanical obstruction which the foliage offers reduces the amount of water which reaches the soil and lengthens the time during which it can do so; the foliage together with the loose litter of the forest floor also reduces the compacting effect of the rain-drops and the drying effect of sun and wind and keeps the soil granular, so that the water can easily percolate; (2) then the mechanical obstruction which the litter, underbrush and trunks, and possibly here and there moss, offers to the rapid surface drainage of waters, lengthens the time during which this percolation may take place; and (3) the network of deeply penetrating roots, live and decayed, offer additional channels for a change of surface drainage into sub-drainage. In addition, owing to the influence on temperature and moisture conditions of the air, together with reduced evaporation, more water becomes available to the soil, and certainly the fact that the water by ready percolation, is wthdrawn from the dissipative effects of sun and wind must tend in this direction. We should consider the protection of our watersheds as much a national problem as the improvement of our water ways, and even more so. —*Dr. B. E. Fernow.*

THE RADIAL TYPE IN PLANTS.—One interesting difference between the higher animals and plants that was long ago pointed out is that the animals have a fore-and-aft polarity while the plants are up and down structures. Still another feature of plants dwelt upon by L. H. Bailey in his "Survival of the Unlike" is the circular form that all vegetation tends to take while animals are nearly all bilateral or two-sided. The tendency to spread out in all directions is very strong in plants. Tree trunks are round and branches are given off on all sides; the leaves, parts of the flower and even the seeds in the fruit are for the most part arranged in circular form while in the highest type of plants, the asters and other composites, the flowers themselves are arranged in this fashion. So characteristic is the rotate form that any deviation from it is at once marked as a specialization and we commonly hold the flowers of orchids and labiates more highly specialized than those with parts regularly arranged.

CROP AND WEED.—It has come to be recognized that there are natural associations of plants and natural rotations of vegetation certainly determined by other than plant food factors. Thus in the Eastern United States, wheat is followed by ragweed naturally while, across the fence, cockelbur and wild sunflowers come in after the corn, the difference in vegetation being as sharply marked after the removal of the crops as when they still occupied the land. Analyses of the ragweed, for instance, although it is a shallower rooted crop than wheat, show that it takes from the soil as much of the mineral nutrients as does the preceding wheat crop. The investigation of Lawes and Gilbert on fairy rings can not be satisfactorily explained by the comparison of the mineral constituents of the soil within and without the rings. Work at Woodburn on the effect of grass on apple trees finds no other plausible explanation than that the growing grass produces in the soil organic substances detrimental to young apple trees.—*Science.*

Accessory Buds.—There are few phases of the plant about which less seems to be known than the accessory or supernumerary buds. These usually occur on either side of the axillary or lateral buds or extend along the intermode for some distance above them. The axillary bud is regarded as the one nearest the center of the leaf scar, and this is unquestionably correct for those cases in which the axillary and accessory buds are arranged side by side, but when the buds are superposed, that is, when several buds occur, one above the other, the lowest bud, which in this case would be defined as the axillary bud, is often the smallest and most insignificant of the lot, and since it rarely grows it may well be questioned whether this is a true axillary bud; whether, in fact, accessory buds may not occur on all four sides of the axillary buds and this be one of them. Nobody doubts the occurrence of such buds on three sides of the lateral buds. A further interesting feature of the accessory buds is the kind of structure to which they give rise. In such plants as bear the accessory buds on both sides of the lateral bud they invariably give rise to flowers, as one may easily discover by examining the peach or the golden bell (*Forsythia*). So far as the writer is aware, there are no flowering plants that produce three twigs above a single leaf scar as would be the case if such accessory buds formed leafy twigs as the lateral buds do. But in the plants with superposed buds the case is quite different. Here it is apparent that these buds seldom if ever produce flowers. Not only this but more than one of these buds may grow. One has only to search vigorous young twigs of the walnut, butternut or *Pterocarya* to find two or more buds showing a tendency to grow and in some cases the buds produce twigs two or three inches long the first year. Clearly such buds are not to be classed with the buds that occur alongside of the lateral buds, and our botanical texts need a little revision at this point. There does not seem to be a very definite idea as to just how much the production of adventitious buds enters into this problem of extra buds at the nodes. If one searches the plants of the world he will be surprised to find buds appearing almost anywhere. Many of these, in fact all that appear at the nodes, are regarded as accessory buds, but who shall say that this view is correct.

Fall of the Leaf.—It is pretty well known that leaves do not fall because of the frost though the approach of a cold season may be responsible for their being cast off by the parent plants. As a matter of fact, many plants never cast their leaves. Mosses, ferns, and the great majority of monocotyledons such as palms and lilies, do not throw off their leaves. When these structures have served their purpose, they wither and droop but remain attached to the plant until decay or the play of the elements have detached them. Most flowering plants however, long before autumn, begin to make preparation for separating the leaves from the twigs. This is accomplished by a "cleavage plane" so-called, which consists of a layer of brittle cells that grows across the petiole and at the proper time causes it to fall. Before this layer of cells is formed the plant forms a layer of cork cells just below the place where it is to form. This often begins as early as June and is manifestly of service in keeping the moisture within the plant when the leaves have fallen. There are two or three layers of cells in the tissue that cuts the leaf off and this begins its growth at the epidemis and gradually spreads across the petiole. Last of all the ends of the vessels carrying water to the leaf are plugged with cork, and the plant is ready to enter the leafless condition.

EDITORIAL

When this issue of *The American Botanist* went to press we had no idea that we would have the opportunity to re-edit it and add a postcript, as it were; but as it turned out after the magazine had been printed and sent to the bindery a fire broke out which completely destroyed the issue and as the metal from which it was printed had already been melted up, the entire magazine had to be reset at the cost of considerable delay. Since our printing is done by another company, this magazine loses nothing but time in consequence of the fire, but as Franklin used to observe "Time is the stuff life is made of" and we apologize to our readers for subtracting from their lives even so small a part is represented by the failure of this magazine to appear on time. At this writing most of the August number is ready and barring accidents, will appear as usual while this present number should be out the first week in July. The building in which the printing firm is located has a rather unenviable record for fires. It has required the attention of the fire department eight times in half as many years. Earlier in the present year another fire in this building delayed the appearance of *The Fern Bulletin* and we begin to feel like adding to our date line the old familiar legend "Providence and the weather permitting." However, in order to show that there is no ill feeling because of the delay, all our subscribers whose subscriptions have expired might renew at once!

* * *

Last month there was passed by the New York State Legislature a bill to incorporate "The Carnagie Corporation of New York" which is authorized to "receive and maintain a fund and apply the income to promote the advancement and diffusion of knowledge among the people of the United States by aiding technical schools, institutions of higher learning, libraries, scientific research, hero funds, useful publications and by such other agencies and means as shall from time to time be found appropriate." Just here is where we are inclined to put up a few lightning rods—or should we now say antennae—for ourselves. If men of means have at last decided to come to the aid of struggling agencies for good in the community, we feel sure that among the first to receive such assistance must be those publications that are endeavoring to foster an interest in botany, nature study and the other outdoor pursuits that lie at the very foundation of the material success of this country. The proposition to incorporate this new Carnagie idea however, does not come as very much of a surprise. For some years signs of a growing interest in the spread of useful knowledge has been manifested by wealthy men. As instances may be cited the bequest of about thirty thousand dollars for the upkeep of the Lloyd Library of Cincinnati maintained for the advancement of botanical science, and the founding of a publishing house in Chicago with a million dollar endowment to aid in issuing useful books which otherwise could not be issued because the demand for such matter is still too small to justify its being printed for profit. The general public is not yet alive to the delights and advantages of scientific studies. On this point, Dr. Richardson in an address delivered at the Minneapolis meeting of the American Chemical Society exprssed himself thus: "Considered by itself, science and the scientific method are the most satisfactory and satisfying things in the possession of the human mind. The unfortunate thing—it can not be classed as a criticism—about science is that it has left the multitude untouched. With the results of science and the scientific method on every hand forming so large a part of our splendid materialistic civilization, nevertheless the great, the overwhelming majority of people are ignorant of the methods, the aims and the results of scientific inquiry in daily use and of daily necessity; of even greater import, the scientific method of thought is not a part of their mental equipment." One of the reasons why the general public has not a more abiding interest in real science is doubtless due to the fact that newspaper writers have so long dealt in a fanciful brand of pseudo-science that the facts seem sober and uninteresting by comparison. To overcome this idea true science needs to be set forth in its best garb, but this cannot be done at present for lack of sufficient support from the public. Should the Carnagie Corporation decide to aid this magazine in popularizing botanical science our readers may expect something commensurate with the treatment the subject deserves. Meanwhile we shall "go it alone" to the best of our ability. But if we notice the Carnagie Corporation looking this way we shall certainly wig-wag the sign of distress.

BOOKS AND WRITERS.

The Country Gentlemen of Albany, N. Y. which for more than four score years has been conducted by the members of a single family, father, son and grandson, has passed into the control of the Curtis Publishing Company of Philadelphia.

A new publication known as *Pomona College Journal of Economic Botany,* and devoted to sub-tropical horticulture has made its appearance. Its editor is Prof. C. F. Baker whose experience as an official of a Brazilian botanical garden, supplemented by much plant collecting in tropical regions, renders peculiarly fitted for the position. The magazine is well illustrated and is issued quarterly at $1.00 a year. The great interest that is now attached to tropical agriculture and horticulture ensures that the new journal will have a wide circulation.

Prof. R. S. Cocks of the Louisiana State Museum has issued as Bulletin No. 1, of the Natural History Survey, a list of the "Leguminosae of Louisiana." It is more than a mere list, however covering as it does about 25 pages and nearly forty plates. It has been the author's aim either to refer each species to a good published illustration or to illustrate it in the list. The distribution and habitat of each species is given with the common names and necessary synonymy, the nomenclature being according to the Vienna rules. Nearly one hundred and fifty species are given, several of them new to science. It is the intention of Prof. Cocks to follow this Bulletin with others devoted to other plant families, which will form a work badly needed in the region, since current manuals have dealt very superficially with the plants which grow there.

Among recently issued books of interest to botanists we note "Nature Sketches in Temperate America" by Dr. J. L. Hancock from McClurg & Co., "The Landscape Gardening Book" by Grace Tabor and "Home Vegetable Gardening" by F. F. Rockwell from the John C. Winston Co., Philadelphia.

Within the past few years discoveries of the greatest importance as regards the evolution of the flowering plants have been made in the realms of fossil botany. Only a short time ago nothing seemed more certain than that the coal measures were formed largely of gigantic ferns and allied plants, now, it is reported, true fossil ferns are somewhat rare, the species once regarded as ferns having quite unexpectedly turned out to be primitive flowering and seed bearing plants. The discovery of this great group of pteridosperms or cyadofilices as they are variously called has opened up an entirely new vista into former geological ages, and renders very timely Dr. Marie C. Stopes book on "Ancient Plants," which is issued by the D. Van Nostrand Co., of New York.

"Ancient Plants" is a very clearly written account of what is known about these plants at present beginning with the various kinds of fossil plants known and the species that occur in coal after which the minute structure of both living and fossil plants is taken up and carefully compared. This fills the first half of the book. The following pages contain the past histories of plant families. These comprise not only the histories of families which still inhabit the earth, but of all those that are now found only in the fossil state, such as Bennettitales, Sphenophyllales and the like. The book is well illustrated, the photo-micrographs of fossil parts being especially good. Though the plants may have lived millions of years ago the cells are plainly to be seen. It will be news, to many that these plants of the far distant past were often more complex than living ones, though with flowers and fruits that seem fantastic in comparison with our own. The price of the book is $2.00 net.

"Domesticated Animals and Plants" by Dr. Eugene Davenport of the University of Illinois, is on the same general lines as the author's previous volume on "Principles of Breeding" but is more elementary in character and designed for the secondary school instead of the college. Essentially the same ground is traversed but fewer statistics are involved with the result that we have a volume suited to the intelligence of those beginning the study of plant and animal breeding. The early pages are devoted to a discussion of the origin of domestic races and the need for improvement and these are followed by numerous chapters dealing with natural selection, variability, the transmission of characters, heredity, adaptation, and other subjects with which the plant breeder must be conversant. The closing chapters attempt to trace the origin of our domestic species of animals and plants. At the end of each chapter there are a list of practical exercises which must prove of great value in directing the efforts of the student. Though intended primarily as a text book for schools, the volume will be found to be exceedingly helpful to any who wish to become informed regarding modern methods along the lines indicated. The book is published by Ginn & Co., at $1.25.

Prof. Fred L. Charles, editor of the *Nature Study Review* and well and favorably known to lovers of outdoors recently committed suicide at the University of Illinois where he was teaching. As no cause for the rash act is known it is supposed to be due to a sudden fit of insanity due to overwork.

Two small worms, inhabiting the waters off the coast of Brittany and neither of them large enough to be seen well without a lens have provided Prof. Frederick Keeble with the materials for an entire book. These worms are known as *Convoluta roscoffensis* and *C. paradoxa* the former being dark green and the other yellow-brown. One of the first things that make these worms of interest is the fact that their living is absolutely synchronized with time and tide which, we are told, "wait for no man" and for no worm either for that matter. When the sun is up and the tide out, these worms come to the surface of the sand in countless millions seeming to enjoy the light, but at the first impact of the waters of the incoming tide they immediately disappear beneath the sand only to appear again when the tide has receded. Prof. Keeble's studies after many years have shown him that the reason for the peculiar behavior of these worms is to be found in the fact that they possess chlorophyll and that they are, in truth, plant-animals, in which there is a true symbiosis between the worms and certain alga cells that inhabit their bodies. During the early part of their existence the worms feed upon the usual microflora of the sea-beach, later they cease to ingest food and live on the products of photosynthesis carried on by the alga cells. The book, which is very appropriately called "Plant-Animals; a Study in Symbiosis" is an interesting and well written account of their habits and of the experiments undertaken by the author to prove, step by step the theories set up in regard to them. The book is from the press of Cambridge University, England but may be obtained of the American agents, G. P. Putnam's Sons, New York. The price is 40 cents net.

Here and there, in response to the demand for a general science course in the high school, outlines and laboratory manuals in the subject are beginning to appear. General science, it may be explained, is the name given a mixture of nearly all the sciences and designed to place the pupil in intelligent contact with his environment. One of the more desirable outlines for such a course has been issued by Prof. Percy E. Rowell, of the Gardenia Agricultural high school. This lists nearly one hundred and fifty topics for investigation which are taken from the more familiar phases of chemistry, physics, geology and biology. In most of these there is first a succinct statement of the facts followed by a considerable list of references for further reading. In our opinion it is likely to prove valuable in a course where information is the object desired. No directions for experiments are included so that the teacher who would teach by the experimental method will have to devise for herself.

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AUGUST, 1911

The AMERICAN BOTANIST

Devoted to Economic and Ecological Botany

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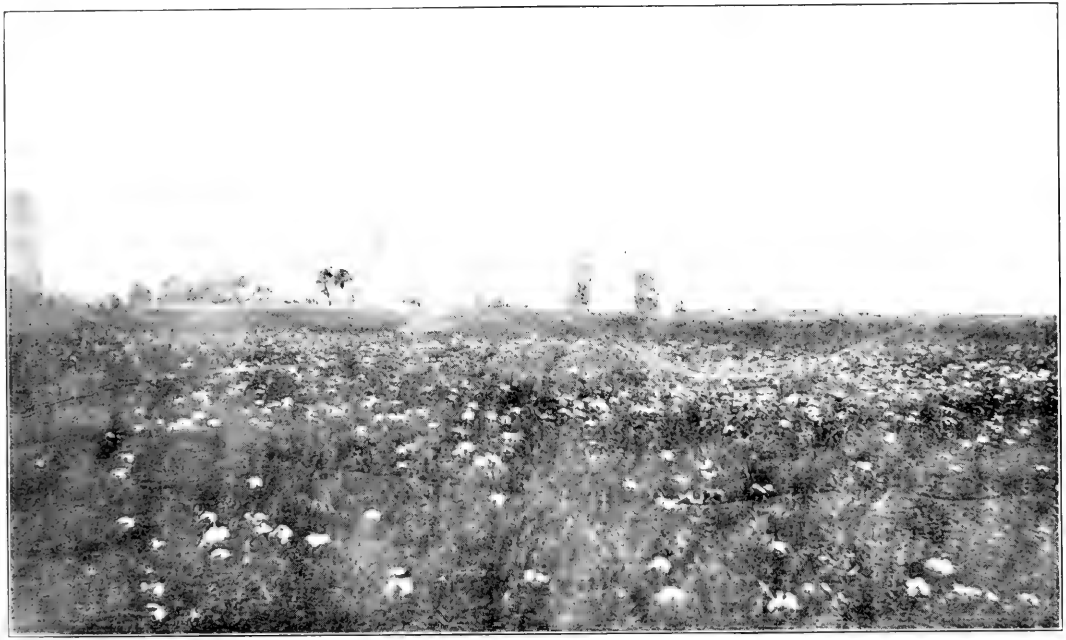

PART OF THE CHICAGO PLAIN IN THE CITY OF CHICAGO.

THE AMERICAN BOTANIST

VOL. XVII JOLIET, ILL., AUGUST, 1911 No. 3

THE FLORA OF THE CHICAGO PLAIN.

By Willard N. Clute.

THE City of Chicago is located on a nearly flat stretch of country, at the head of Lake Michigan, known as the Chicago plain. This plain is from ten to to fifteen miles in width and once formed part of the floor of a great glacial lake a remnant of which still exists as Lake Michigan. Westward and southward the plain is bounded by a broad belt of intermingled sand gravel and clay known as the Valparaiso moraine which formed the shore of the ancient lake at this point, and was, in fact, largely the cause of it, since it held back the waters of the melting ice sheet until they found a way out by way of the "sag" and the Desplaines valley into the Mississippi.

At present the plain averages about twenty feet above the surface of Lake Michigan, but it still bears evidences of its recent and watery origin in extensive stretches of marsh-land and general lack of drainage. In the parts that have not been artificially drained the few inhabitants regard the rubber boot season as a natural condition to be accepted with the same fortitude that summer drouth and untimely frosts are endured. During the spring rains, extensive "wet weather lakes" may be formed over large tracts that are dry enough in summer to produce a fair crop of hay or in some instances garden crops, but which at this season are impassible to one ordinarily shod. The soil is almost exclusively a deep and impervious clay, though darkened by the decaying vegetation that for many centuries has grown upon it. Here and there one finds sandy ridges or mounds which mark the location of ancient lake beaches, or of shallows in the lake itself. These are covered with a flora that differs in some respects from that of the rest of the area, but which only serves to emphasize the uniformity of the flora in general. Trees appear never to have flourished here. A few willows and cottonwoods may be found in swampy spots, and oaks have gained a root hold on the sandy ridges, but for the most part, it is a treeless and prairie-like region.

There are still many areas of considerable size in this region that have never been turned by the plow and still support a virgin flora unspoiled by the operations of the farmer, save for an occasional mowing. This condition, however, is not likely to last much longer for the city is fast encroaching upon it. The soil is being drained, market gardens begin to appear where but recently the sedges and wild grasses held sway, and an occasional dwelling rising out of the mud on stout posts presages the solid blocks of buildings that are to be.

Having had occasion to traverse several square miles of the most typical part of this plain daily during the past spring, it has seemed to me that a few observations upon the flora are worth while before the spread of the city forever makes such notes impossible. Notwithstanding its nearness to a big city on one hand and to a well forested region on the other, it has many characteristics of its own that are likely to strike the visitor as uncommon.

As may be inferred from the nature of the soil, the region is slow to warm up in spring and such species as are common to this and adjacent regions, strongly emphasize the difference in temperature by blooming here from one to two weeks later than elsewhere. That this difference cannot be attributed to locality is shown by the fact that when the first flowers open on the plain, the same species not two miles away, but growing on the moraine, are in full bloom. There is a noticeable absence of the flowers of early spring. One looks in vain for such plants as hepatica, bloodroot, adder's tongue, Solomon's seal, trillium, spring cress, rue anemone, and Canada ginger. Even typical marsh plants like the skunk's cabbage and marsh marigold are absent. All these, and many more are abundant on the moraines but in all the years that they have grown there they do not seem ever to have ventured out upon the plain. Most of these have gone out of flower on the moraine before flowers of any kind appear on the plain. Indeed the region has no early spring flora. While buds are opening and green shoots springing in abundance elsewhere, the plain lies flowerless and passive, reminding one of the environs of New Orleans under similar circumstances. The first flower to appear in spring is the cosmopolitan dandelion followed soon by the mouse-ear plantain and *Carex Pennsylvanica*. For a long time these are the only blossoms to be found, but as they fade, the wild strawberry and one of the blue violets cover the ground with their blended colors.

The alliance of the flora is plainly with that of the prairie. This is more noticeable in autumn when sunflowers, blazing stars, compass plants, golden-rods, rudbeckias, asters, and other characteristically prairie plants monopolize the soil, but the likeness is noticeable even in spring in the occurrence of such plants as the shooting star, downy phlox, orange puccoon, Indian plantain, tall phlox and prairie dock. Another feature characteristic of the prairie is the abundance of such flowers as occur at all. When any species blooms, it is likely to become the most conspicuous thing in the landscape. For a time it has the center of the stage and none can fail to note it. The squaw weed (*Senecio*) that elsewhere may appear in scattered bunches, here covers square miles with a solid spread of yellow that no eastern field of butter-cups can surpass. In another field a yellow of lighter hue interspersed with flecks of orange and scarlet show where the painted cup flourishes. Soon these disappear and are succeeded by a wide-spread rosy tint which heralds the blooming season of the tall phlox. In such a region as this violets of several species flourish. The lance-leaved violet forms compact beds, covering hundreds of square feet growing so thickly that fifty plants may be lifted by one thrust of the spade. One of the blue violets, with peculiarly attractive wine-colored flowers gives its color to the whole region for a week or more.

After one has listed all the plants to be found, he is likely to be astonished at the small number. During the first six months of the year, less than fifty different species have bloomed if grasses and sedges are omitted. There is a noticeable lack of those species which store up food in underground parts. This in a measure explains why there are no early flowers on the plain, but the question why such species should be absent is quite another matter. Apparently soil, shade and the all pervading moisture are jointly responsible for their absence. The presence of some others is almost equally difficult to explain. The star grass, for instance, which elsewhere is an inhabitant of dryish woods, grows here in the wet grounds, and the purple oxalis keeps it company. Although the region is crossed by several railways the absence of exotic weeds cannot fail to be remarked. With the exception of the dandelion, there are no plants in the list that have come to us from the Old World, though many species of these may be plentiful enough along the railway embankments.

In mid summer, the vegetation of the plain, being for the most part shallow rooted, is frequently injured by drouth, while in winter and spring the other extreme is met. This wide variation in the amount of moisture has doubtless played a part in the development of the plant covering of the region, and a closer study of the plants will doubtless discover some with differences of sufficient importance to warrant their being described as new forms. Some of these already noted are now being kept under observation and further notes upon them may be presented at another time.

The following list of the species found during the first six months of 1911, is arranged in the order in which the species were found in bloom. It will be noted that the majority are marked either abundant or common. This bears out the implication made that though the flora is extremely limited as regards the number of species, it is at no time lacking in flowers, but on the contrary is more heavily spread with bloom than any other locality adjacent.

LIST OF SPECIES.

Taraxacum officinale. Dandelion. Abundant.
Antennaria sp? Mouse-ear plantain. Common.
Fragaria Virginica. Strawberry. Abundant.
Carex Pennsylvanica. Sedge. Abundant.
Viola Sp? Blue violet. A species near *ovata.* Very abundant.
Pedicularis Canadensis. Lousewort. Common.
Oxalis violacea. Purple oxalis. Not common.
Houstonia coerulea. Bluets. Common.
Claytonia Virginica. Spring beauty. Rare.
Hypoxis erecta. Star grass. Abundant.
Viola lanceolata. Lance-leaved violet. Abundant.
Viola obliqua. Common blue violet. Not Common.
Viola pedata. Bird-foot violet. Rare. On sand banks only.
Vaccinium Pennsylvanicum. Blueberry. Rare, in sand.
Vaccinium Canadense. Blueberry. Rare; with the preceding.
Commandra umbellata. False toad-flax. Abundant.
Dodecatheon media. Shooting star. Not common.
Potentilla Canadensis. Cinquefoil. Abundant.
Phlox pilosa. Downy phlox. Common.
Zizia aurea. Golden Alexanders. Tolerably common.
Lithosperum pubescens. Orange puccoon. Not common.
Lithospermum angustifolium. Yellow puccoon. Rare.
Ranunculus cymbalaria. Celandine. Very rare.
Castilleja coccinea. Painted cup. Abundant.
Senecio aureus. Squaw-seed. Very abundant.
Heuchera Americana. Alum root. Common.
Sisyrinchium sp? Blued-eyed grass. Common.
Krigia Virginica. Cynthia. Abundant.

Lobelia spicata. Spiked lobelia. Common.
Lathyrus palustris. Vetch. Common.
Rudbeckia hirta. Black-eyed Susan. Very abundant.
Rosa blanda. Smooth wild rose. Plentiful.
Oenothera sp? Sundrops. Abundant.
Erigeron stringosus. Daisy fleabane. Abundant.
Calopogon pulchellus. Grass pink. Abundant.
Achillea millefolium. Yarrow. Plentiful.
Iris versicolor. Blue flag. Common.
Polytaenia Nuttallii. Not common.
Cacalia plantaginea. Indian plantain. Common.
Parthenium integrifolium. Prairie dock. Common.
Phlox glaberrima. Meadow phlox. Abundant.
Lythrum alatum. Loosestrife. Abundant.

A SUNNY CROP.

By Miss Nell McMurray.

THROUGHOUT the summer the goldenrods have been demure and busily storing sunshine; late in the season the sunshine re-appears in their flowers—in hedges, by the roadside and in forsaken fields—making ideal spots for the storing of sunny thoughts in a walker's heart.

The earliest and the latest the smallest and the straightest, of this group of golden flowers, is *Solidago erecta.* We may find it blooming from the middle of August to the middle of October. Even so late as the middle of November a bit of yellow may be seen in the tiny leaves that enclose some of the late seeds. The plant is stiff and displays small clusters of pale yellow flowers in the axils of its upper leaves. 'Tis a plain creature but has good lasting qualities.

Solidago nemoralis is rather lowly, but full of grace and brightens a field more than any other of these friends. The deep, bright yellow flower-heads are crowded into dense, drooping clusters. *S. nemoralis* keeps *S. erecta* company by continuing its blooming after the others have faded, the lowliest keeping their beauty longest.

The tall *S. juncea* is the most graceful and grows in small clumps. The rather pale yellow flowers are in small heads which are arranged in loose, spreading clusters. It blooms early and we are tempted to carry it home though it is most beautiful where it waves above the wild grass in the field.

Our most common goldenrod, *S. rugosa,* is tall, sturdy and forms compact hedges in fence rows and great colonies in swampy fields. The flower cluster is broad and spreading. Only a few of the green-yellow florets are open at one time, making it a dingy goldenrod. When the sunny days of the rank *rugosa* are past, it often cleverly hides the stately blooming ladies tresses. One wonders at the congeniality of such plants!

The flowers of *S. graminifolia* resemble those of *rugosa* in color, being green-yellow, dull for a goldenrod. The flat topped flower cluster is a striking feature of this sturdy, common plant.

Our white goldenrod, *S. bicolor,* is more appropriately called silver-rod. It grows in small, scattered clumps and is sometimes tall—though it always has an unassuming appearance. The white florets are small and the heads are crowded in short recemes in the axils of the upper leaves.

A clump of the handsome, tall goldenrod, *S. altissima* attracts attention when one is across the field from it. The prominent, pyramidal cluster of yellow heads is fluffy, feathery and a bright yellow. Nearly all the florets are open at one time. Why is it fluffy? Because the pistil and stamens extend beyond the corolla and the strap-like corollas are long, narrow and numerous.

S. canadensis, somewhat resembling *altissima,* grows in a large mass in an old field. It is short in stature, has smaller flower clusters and the corolla is a paler yellow than *S. altissima.*

The wanderer, *S. caesia,* lives far from our other goldenrods, in the deep, moist, deciduous woods. The prettiest plants have simple stems, drooping gracefully. One notices at once the tiny clusters of flower heads in the axils of the upper leaves. Though the heads have few ray flowers, the corollas are large and bright, the disk flowers are also few and bright. Each species has its own shade of yellow while in flower and when the gray days have come and the seeds fly away under a fairy sail, each species retains enough individuality to distinguish it from its neighbors.

These sunny flowers make sunny hours—not alone when blooming in the field. The result of their labor extends far into the cold winter, when sunny thoughts make sunny hearts.

New Washington, Pa.

THREE BIG PERENNIAL ROOTS.

By Elmer Stearns.

FIFTY miles south of Juarez, Mexico the Candelaria ranch, owned by the Escobar Brothers of this Agricultural College is located and this was recently the scene of a few days pleasant work collecting plants for the College Herbarium and for the Mexican Government. I was met at the train by Camilo, the manager of the ranch, a typical, thin, wiry Mexican of about 50 years of age, and ready always to help me in anyway possible.

The ranch house is about 5 miles from the station. Upon reaching it we indulged in a "regular fare" meal, which you either eat or go hungry:—beans, tortillas, and coffee. They make some cheese at this ranch so we had both milk and a white curd cheese in addition. The floor of the dining room is packed dirt, the chairs are benches, in one corner is the cheese press another had a sitting hen, and besides her lay a big brown greyhound. Another corner was the fireplace where the Senora sat baking our tortillas, while on the beams that supported the dirt roof were a number of swallow nests whose owners flew over the table on their trips through the door.

Early in the morning we hitched up a span of little, wiry mules and started for Rancheria Mountain, some 10 miles away. The first 5 miles was across about as dry a region as one could expect to see, nothing green in sight except the scattered plants of the pretty *Jatropha macrorhiza,* which the Mexicans call "Jicamilla" this name being given for its resemblance to "Jicama" a species which is a common food product among them. The plants were in flower and presented a very attractive appearance, everything else being brown and parched, since there had been no rain for about a year. We began to dig out the root, which was of about three pounds weight, and was located about 8 inches beneath the surface of the soil. It was no easy matter to get it out. A very good description of this plant is found in "Botany of West Texas," in Vol 2 "Contributions to the National Herbarium."

Passing on a little distance we saw flowers of a pretty yellow color, standing up, several inches above the prostrate plants. This is what is locally called "Melon del Coyote" and is *Apondanthera undulata* also described in the Botany of West Texas. It has a perennial root of a russet brown color on the surface, which is also located deep in the hard, dry soil. From the summit, there grows a stem of the same scaly brown color and when it reaches the surface of the ground, the regular green stems grow out, branching very freely in all directions. The male flowers are in thick, erect racemose corymbs, and from the axils of the lower leaves while the female flowers are solitary in the upper axils. There may be 10 or 15 bright yellow male flowers in each raceme, and when they are all open in the morning they present a most attractive sight. The fruit is round, reddish yellow and 7 to 10 centimeters in diameter.

Going up into the foothills of the mountain we came upon *Maximowiczia tripartita,* Var. *tenuisecta,* this plant has a brownish, scaly and conical root, weighing several pounds, buried some 6 to 10 inches below the soil. It took quite an effort to get it out, but I have roots of all three plants growing in my garden. They will, no doubt, all fruit with me. They are all very interesting and might be improved by crossing and made still more useful. Some study has been given the Jicomilla by a Mexican Botanist of Chihuahua, Dr. Hernandez. After collecting many other plants along the route, we came into the Rancharia Mountains and about the first thing of interest, after a good feast on the ripe fruit of *Cereus stramineus*, which grows in great abundance there, we came upon a part of the mountain where large areas were so well covered with *Selaginella lepidophylla* that bushels could be gathered. We then sat down to a lunch of tortillas, beans, meat and cold coffee and then returned to the ranch, killing a rattler on the way.

A NEW SPECIES OF PHLOX.

By Willard N. Clute and James H. Ferriss.

AMONG the flowers of late spring that make the prairies and woodlands of northeastern Illinois a riot of color, four species of phlox are conspicuous. The well-known sweet William (*Phlox divaricata*) is first to appear, its favorite haunt being the moist open woods where it thrives in spite of the annual cropping by cattle. For long distances it spreads among the trees in unbroken sheets of purplish bloom and it may even venture into the open fields where, however, it comes into competition with another species. This latter species is the downy phlox (*P. pilosa*) a characteristically prairie species with small clusters of pink flowers that are familiar features of open roadsides, railway embankments and sandy barrens but show no tendency to invade the woodlands. *Phlox divaricata* begins to bloom about the middle of April, varying somewhat according to season, and *pilosa* usually appears about three weeks later.

Late in June, more than a month after *divaricata* has ceased blooming and a safe distance behind the flowering season of *pilosa*, the deep pink flower-clusters of the meadow phlox (*Phlox glaberrima*) begin to appear in low grounds. This is easily our handsomest phlox with its profusion of large flowers of deepest pink borne at the top of smooth wandlike stems that rise above the grasses amidst which it grows.

Until recently this was supposed to complete the list of the native phloxes of this region, notwithstanding the fact that another species has always been present, has frequently been collected by botanists and has been in cultivation for some time. This species has long been confused with *pilosa* and, indeed, when the plant is studied in the herbarium instead of in the field it is so nearly like it as to deceive the very elect. Nevertheless it has characteristics so distinct, albeit they are not of a structural nature, that we unhesitatingly assert its distincness as

PHLOX ARGILLACEA N. S.

Stems erect, tufted, downy, 18-30 inches high, usually branched above. Leaves light green, downy, especially on the margins, narrowly lanceolate or linear, long pointed, with margins inclined to be revolute, sessile. Flower cluster rather open, many flowered forming a level cyme. Flowers short-pedicelled. Calyx and bracts, glandular hispid the long and very attenuate calyx tips especially so. Tube of the corolla, half an inch or more long, purplish and pubescent on the outside. Limb white or occasionally pale lilac about half an inch in diameter, its divisions entire, round ended, narrowed below with margins usually revolute, each marked near the throat with two linear, pale lilac nectar guides. Young seed pods viscid. Flowers fragrant. Found in shaded or exposed clay or sandy soil seeming to prefer the former. Oak Forest, Cook County, Illinois and Liverpool, Lake County, Indiana. Flowering season from about June 1st to August 1st. Type in the herbarium of J. H. Ferriss.

Although, as we have indicated, the structure of this species is very similar to that of *pilosa*, anyone familiar with the two species as they grow in field or garden has no difficulty in distinguishing them. The new species is well characterized by its lighter green leaves, greater height, less compact flower-clusters, restricted habitat and above all by its pale flowers and later and longer season of bloom. *Argillacea* does not begin to bloom until some time after *pilosa* has passed its prime and when in full bloom no flowers of *pilosa* are to be found. The height of its blooming season is the season at which the first blooms of *glaberrima* unfold. *Argillacea* averages nearly twice as tall as *pilosa* and generally forms more compact clumps sending up a succession of flowering stems. One of the most singular circumstances connected with its distribution is the fact that while many roads and railroads lead from its habitat across the prairie, *argillacea* declines to venture along them while *pilosa* is abundant throughout. It is evident that the descriptions of *pilosa* in the manuals have been drawn to cover these two forms but there is too great a difference in their time of blooming, color, size and habitat to admit of the two being grouped as one species. For some time the plant has been under observation in the garden growing close beside *pilosa* and in the same kind of soil and under similar treatment shows no tendency to intergrade with it. Albino forms of *pilosa*, which bloom at the same time as the normal plant and have the same general appearance have also been under cultivation by us and in no way resemble the new plant except in the lighter color of the flowers. The albino flowers of *pilosa* are, in fact, pure white, while *argillacea* appears to always be lilac-tinged, at least as regards the tube of the corolla.

NOTE AND COMMENT

Wanted.—Short notes of interest to the general botanist are always in demand for this department. Our readers are invited to make this the place of publication for their shorter botanical items. The magazine is issued as soon as possible after the 15th of February, May, August and November.

Bird-foot Violet Leaves.—It would not be difficult to induce the student of plants to agree to put the bird-foot violet (*Viola pedata*) in a genus by itself. It is so unlike the other American violets that it has always occupied a separate section in the violet genus, and it would not be straining matters much if the section itself were expanded into a genus. One of the most interesting and unique of this violet's characteristics is the way it has of bearing its two sets of leaves. As most students are aware, the violets are inclined to produce two sets of leaves that differ considerably in appearance. In our common violets, however, one set of leaves succeeds the other gradually, each new leaf having fewer of the characteristics of the early leaves, and more of the characteristics of others to come later. In the bird-foot violet, this succession is managed quite differently. When spring has really begun, the bird-foot violet sends up its flowers, accompanied by long-stalked, deeply-cut leaves. These remain on the plant until the seeds are ripe, but since this violet grows in sandy soils exposed to frequent summer drouths, the leaves may entirely disappear during the warmer parts of the year. Late in summer, when cooler weather and more copious showers make a more propitious season, a new set of leaves are produced that are much different from the first set. They are very short stemmed, rounded in outline with smaller and less narrowly divided leaflets. This second set of leaves remains on the plant throughout the winter in sheltered situations and give place to the other leaves in spring.

Imported Insect Pests.—Everyone who owns a garden is fully awake to the harmfulness of our insect pests. It is frequently an impossibility to raise certain crops that are the favorite food of such insects. Many of these pests came to us from foreign parts in poorly inspected nursery stock; in fact most of our worst pests are of Old World origin. Among the number may be named the hessian fly, asparagus beetle, hop-louse, cabbage worm, house fly, wheat louse, oyster shell bark louse, pea weevil, gypsy moth, brown tail moth and croton bug. Among introductions from other parts of the world are San Jose scale, Argentine ant, cotton boll weevil and alfalfa leaf weevil. These cause more than a billion dollars damage to cultivated crops annually and seem to be increasing in numbers in spite of the means taken to combat them.

Changes in Ivy Leaves.—I have never happened to see recorded the fact of such a marked change in shape of the leaf as occurs with ivy whenever it flowers. The change is from the ordinary type to a broadly ovate outline without indentations, resembling in form, though not in color or texture, those of some species of *Populus*. Whenever leaves of that shape are found on the English ivy, flowers are usually to be found. This season, a similar change in the form of the leaf was noted on some parsley plants which have been persistently striving to flower, and run to seed, and it seems likely that closer observation may show the same thing with many other plants.—*Elwyn Waller, Morristown, N. J.* [Lord Avebury, in his "British Flowering Plants" alludes to this change in form and mentions *Ficus repens* as another species of similar habits. In suggesting a reason for such changes, he says: "It is important to the leaves to secure as much light and air as possible, and when growing on a flat surface the ivy shape enables the leaves to fit into one another and to cover the whole surface. On the other hand the flowering branches grow up into the air. The leaves are arranged round the stem and under these conditions an oval form is more suitable. According to the same writer the interior of the leaf differs according to the amount of light it receives. In the sun two layers of palisade cells are developed under the upper epidermis while in the shade the whole interior of the leaf consists of rounded cells. The same thing is said to be true of the leaves of the common dandelion. ED.]

THE POLLINATION OF YUCCA.—The pollination of the various species of yucca by the pronuba moth, although well known is a never failing source of wonder and interest to the flower lover. Here we have a flower whose six stamens are far too short to be of use in pollinating the individual blossom in which they live, and a pistil whose receptive surface is so located that neither the wind nor the ordinary visiting insect is effective in pollination. At this juncture the special guardian of the flower, the pronuba moth comes in. Gathering the pollen from the anthers by mouth parts specially formed for the purpose she deliberately flies to another flower, climbs up to the stigmatic chamber and packs the pollen into it with a sort of hammering motion that is plainly visible to the observer. Without these ministrations of the moth, the yucca is incapable of setting seed and its distribution or spread in the wild state is absolutely dependent upon this, otherwise insignificant insect. All this is wonderful enough but not half so interesting as the questions it raises. Back of the way in which pollination is effected lie the speculations as to how this association of insect and flower have been brought about. When did the species learn that it could safely trust its continued existence to the ministrations of an animal and how did it happen that the body of this insect was modified at just the right time and in just the right way to be of service to the plant? To be sure the insect does not guard the yucca for mere pleasure for before she places the pollen on the stigma she prudently lays one or more eggs in the ovary where the larvae can feed upon the developing seeds, but how did she know that pollination was necessary to seed formation—many a grown up human being does not know that! And even knowing this, how did she discover how to go about the work of pollination? Among the "lords of creation" only a few specialists are familiar with the process. Probably this is the only insect in the world that intentionally cross pollinates flowers. Nature has been kind to the moth also in the matter of dress. She is colored exactly like the stamens and when resting head down in the flower—her favorite position during the day—can hardly be distinguished from those organs. Just before dusk she begins her self-appointed task and any body who has access to a clump of blooming yuccas may see her at work if they will. Her progeny, fond as they are of young yucca seeds, always leave some to ripen and thus keep up the supply of yucca plants.

Orientation of Radishes.—A short time ago, *Horticulture* published a story to the effect that a Jap has discovered that the radish and other root crops always put out their lateral roots in an east and west direction, in consequence of which we were advised to always plant such crops in rows running north and south so that the lateral roots might push out into the soil between the rows and thus get more food. A little observation however has shown that the Jap was only partly right. The basis for his statements is simply this: the radish produces its lateral roots in two lines lengthwise of the main root. Sometimes these push out east and west and sometimes north and south. It seems to be merely incidental which way the roots should project; otherwise we should have to give the plant credit for ability to discern the points of the compass,—a thing no plant can do. Even the compass plant turns its leaves under the stimulus of heat or light, never magnetism. Other root crops unlike the radish produce their rootlets upon all sides of the tap root and thus a beautiful theory falls to the ground and with it falls the hopes of the farmer who may have been figuring upon greater profits from an educated race of radishes.

Poisonous Hyacinths.—Some alarmist among the plantsmen has discovered that among those who handle hyacinth bulbs there is an occasional case of inflammation of the skin attributed to the irritation caused by the raphides from these plants, and the suggestion has apparently been made in all seriousness that this handsome spring flower be banished from our gardens and the public parks. Whatever may be the effects upon a few persons of handling hyacinth bulbs, it is certain that only a very few persons are thus affected, and it would seem to be about as sensible to abolish hyacinth culture on this account as it would to banish strawberries because a few people break out with a rash after eating them, or to cease keeping bees because an occasional individual is subject to honey sickness.

The Branching of Trees.—In noticing tree branching during the past winter, with a view to directing children toward observation of that kind, calling attention to the most obvious point—the central axis—has seemed to be probably the best starting point. The insistence of conifers on maintaining the central axis to such an extent that if the top has been broken off by wind or another tree falling on it one of the branches of the topmost whorl will turn upright and take the lead; on the other hand with the hardwood trees, there is a tendency more or less marked to split up the central axis until there is practically no main trunk, of which the elm is the most marked example. Of course next would come the direction taken by the branches as they leave the main stem. Usually a compromise between a tendency to grow at right angles to the stem they are leaving and a tendency to grow perpendicularly upward. In the hardwoods the white oak seems to be the most successful in driving its lower branches out horizontally, which gives a particularly sturdy appearance.—*Elwyn Waller, Morristown, N. J.*

CLEAVAGE PLANES OF SMILAX.—The common green briar or cat briar (*Smilax*) of low thickets and fence rows is uique in several respects. For one thing it, and the other species of the genus, are the only woody monocotyledons in the Northern States and in some places comes near to competing with the yucca for the title of the only evergreen monocot. Late in the year the green briar reluctlantly drops its leaf blades and then we discover that unlike monocots in general it has developed cleavage planes to assist in getting rid of them. It is interesting to know that monocots can develop cleavage planes when necessary and still more interesting in this particular case to discover that the plane is not developed where the leaf joins the stem of the plant as in most species, but occurs where the leaf-blade joins the petiole and leaves the latter as a short hard stub guarding the lateral bud all winter. It is possible that this protection to the bud is one of the reasons why the petiole is not cut off, but the most important is evidently the fact that the stipules act as tendrils and to cut off the whole leaf would leave the plant without support.

CURIOUS FORMS OF GAILLARDIA.—On the prairie of the middle west and extending into Louisiana and Texas grow several species of showy composites that have been introduced into cultivation under the name of blanket flower. Some of the species are annual and others perennial, but from various indications it is likely that those cultivated may be hybrids. At any rate they are among the showiest of our garden plants beginning about mid-June to put up large daisy-like heads whose rays are bright yellow at the tips and deep red at the base. The disk flowers, also, are brownish red. Many variations of coloring in the ray flowers occur. Some are all yellow but in most the red is very conspicuous. Normally the rays are flat and three parted at the tips, but in the editor's garden, there has appeared for the past two summers a form in which the ray flowers are replaced by large tubular flowers three- four-or five-parted, with yellow borders and deep red throats. The deviation is in sharp contrast to the usual form and makes the variants look like a different species. After one has cultivated the wild flowers a while, he loses a great deal of respect for the minute distinctions of the systematist. In the herbarium it may appear that a hard and fast line bounds each species, but in nature it is not so.

VARIATIONS IN COMPOSITES.—Most persons, whether botanists or not, can recognize the inflorescence of the great composite family at sight. To the uninitiated a dandelion or daisy may be a single flower instead of the compact bunch of flowers with which the botanist is familiar but the general arrangement is such that an unfamiliar member of the family is recognized at once. But while a fundamental type is discernible in all these flower heads, this is so overlaid and modified by variations of different kinds that the diversity exhibited by nearly twelve hundred species is easily within the limits. At the outset we find the family naturally falling into several lesser groups according as their flowers are all tubular, all strap shaped or a combination of the two. In our southern states and elsewhere in the tropics the section with heads of tubular flowers again divides into species with regular florets and others with two lipped corollas. The members of the compositae are practically never double in the sense that we speak of a double rose or butter-cup. All double composites are derived from species that normally have disk and ray flowers that differ in form. In such, the disk flowers may take on the form of the rays, and give us such forms as "double" daisies, sunflowers, dahlias, and the like. To these variations in the general form and arrangement of the florets must be added the differences that exist in the manner of producing seeds. In some the outer circle—the ray flowers—are the only ones that are fertile, in others only the disk flowers bear seeds, while in still others both ray and disk flowers participate in seed bearing. Normally the disk flowers bear both stamens and carpels, but either set may be missing and the same is true of the ray flowers. Another curious thing is connected with their colors. As everybody knows, certain genera may run to yellow-flowered forms and others to blue pink or purple but a single genus rarely contains species with flowers of both colors. In the genera with yellow flowers albinos are rare—who ever saw a white dandelion, or sunflower?—but in the blue and red flowered genera albinos are common. As might be inferred from their structure, the greatest amount of variation, aside from such qualities as height, hairiness, and leaf forms, is to be found in those flower heads that possess both ray and disk flowers. Here variation may be manifested in the number of rays or in their shape. Quilled forms which after all are possibly reversions to the original form of the flower, are common and when the rays are flat there is often a great difference in their width. Fasciations of various kinds also occur. One has only to search the nearest field of daisies, black-eyed Susans, or any abundant composite to discover many of these variations for himself.

The Struggle for Existence.—The results of Darwin's remarkable work are so widely known that practically everybody has at least a theoretical knowledge of the struggle for existence, but few really realize how important a factor this is in the life history of a given plant. Recently the writer was impressed with this when examining an especially floriferous species of mullein of European origin known as *Verbascum pannosum*. A careful count of an average flower spike discovered the fact that there were on the single plant no less than twelve hundred and eighty-seven flowers and flower-buds. Nearly all species of mullein set seed freely and this species is no exception. Allowing thirty seeds to a capsule, which is rather under the average than above it, we have more than four thousand seeds from a single plant. It is little wonder that mulleins are common in suitable places. All these seeds, however, cannot grow though doubtless many spring up only to be crowded out by some relative more fortunately situated. A short time ago, we observed great numbers of some seedling spurge growing in a low spot in a meadow and out of curiosity removed a square inch of soil and counted the number of seedlings upon it. There were one hundred and seventeen, each trying to develop in a space not large enough for one, and in the midst of square yards as thickly populated.

THE TALLEST TREE.—In New South Wales, Victoria and Tasmania grows a species of gum-tree, *Eucalyptus amygdalina* which probably represents the tallest of all trees on the globe. The loftiest specimen of this tree yet measured towers to the height of four hundred and seventy-one feet. A prostrate tree measured in Victoria, was four hundred and twenty feet long and the distance from the roots to the lowest branch was two hundred and ninety-five feet. At that point the trunk was four feet in diameter, and three hundred and sixty feet from the butt the diameter was still three feet. The wood of this tree is hard and of good quality. It grows quickly and yields a great quantity of volatile oil from its leaves which are very abundant.

SWAMP VEGETATION OF JAPAN.—We are frequently told that the vegetation of Japan and Eastern North America resemble each other in a number of particulars, but we rarely appreciate how close the resemblance is at times. A Japanese botanist has recently published in the *Botanical Magazine* an account of the vegetation of a swamp near Tokyo, and the list of species reads like that which one in the Eastern States might make for his own locality. In this list we note the identical species we have at home of eel grass (*Vallisnera*), pondweed (*Potamogeton*), water milfoil (*Myriophyllum*) hornwort (*Ceratophyllum*), wild rice (*Zizania*) cat-tail (*Typha*), bladder wort (*Utricularia*), reed (*Phragmites*), water plantain (*Alisma*), sweet flag (*Acorus*), smart weed (*Polygonum*) and buttercup (*Ranunculus*), while many other genera common to the two regions are found, such as *Azolla, Salvinia, Nymphaea, Brasenia, Scirpus* and *Nuphar*. Botanizing along the waterways of Japan would be much like an expedition in our own country and lack many of the elements of novelty. In drier ground, however, there would be a greater difference. The water vegetation consists almost entirely of simple forms that are widely distributed over the earth.

Tricotyledons.—While thinning out some radish seedlings the other day I found two that, instead of having two seed-leaves or cotyledons, had three. This abnormal condition has, I believe, been observed in other plants, but it occurs very rarely.—*Edwin W. Humphreys, New York.* [De Vries notes in his "Species and Varieties, Their Origin by Mutation" that tricotyledons are more numerous in some species than in others. By careful breeding he was able to obtain in some instances 90% of tricotyledons in a given crop of seedlings, but in other cases only one or two plants in a hundred had the abnormality. Another interesting form that may be looked for whenever large numbers of seeds are sown is one in which the cotyledons are united. This occurs as often in some species, as tricotyledons do. While two is the highest number of cotyledons any plant normally bears, execept in the pines where they may be as many as fifteen, it is not rare to find four, five or even more cotyledons.—Ed.]

Biennials.—The carrot is a biennial—so the books say—but it is not uncommon to find in a field of carrots, specimens that fruit the summer the seeds were planted. The whole philosophy underlying the development of biennials is that certain plants must first secure a store of food before they can form their flowers and seeds. It takes the radish only a few weeks to accomplish this, but carrots, parsnips, salsify and the like require a longer period. When the season happens to be favorable and enough food is secured there is no reason why these plants should not follow the example of the radish. The conception of a biennial therefore, is not as definite as that of the annual or perennial. Biennials are more likely to be influenced by weather and climate. In regions with a long growing season, the line between annuals and biennials breaks down more or less completely.

Storage Organ of the Live Oak.—A large number of plants store their food in their roots and this is supposed to be because it is safer there, being protected by the earth from too great evaporation, many animals, and various other harmful agencies. Storage of food in this way is usually carried on by mature plants; it is seldom that one finds a mere seedling so worldly wise. Such cases occur, however. The seedlings of the giant cactus apparently appreciating the fact that they are to grow in a dry region store up a quantity of water in the caulicle, and often in this way become attractive morsels to birds and other animals on the lookout for juicy food. The seedling of the live oak does not store up water and it has no need to store food at once, since, like other oak seedlings it has been provided with a good sized food store within the cotyledons, but it does not seem satisfied to follow the custom of the others and draw upon this foodstore as needed. Instead it sends out upon germination, a much elongated common petiole which enables the short root to penetrate the soil. Then the young root enlarges, and the food stored in the acorn is promptly carried down and deposited in the root. Having thus got its food down into the soil out of harm's way, the young stem begins to grow from the top of the root pushing apart the base of the long petiole to do so. The process is illustrated in the *Plant World* for May.

Sterilizing the Soil.—Every spring I burn up dried leaves, brush from pruning and other litter of the kind, on the ground which is afterwards spaded and seeded down. It has been noticed that the plants were most luxuriant at the spots where the fire was made. The simple fact of fertilization by the plant ashes alone was found by experiment to be insufficient to account for the difference, because hoeing off the ashes and spading them in in another place did not cause quite so vigorous a plant growth. Having in mind, numerous experiments as to sterilizing soils before seeding down, which have recently been recorded, the experiment was tried of spreading the litter so far as might be over the major part of the garden plot, before burning it up. That was tried this spring with very good results. It is noticeable that wherever the fire burned fiercest or longest, the soil appears more fertile, though in all other respects the treatment was uniform. The results are almost unexpected for it seems scarcely possible that a sterilizing effect could have extended as deeply as the length of a spade blade, yet after burning over the soil was turned up by spading to that depth. Our soil is very sandy, and in the garden plot only shows humus to the depth to which it has been cutivated by digging in manure, leaf mould, etc. Below that the sandy character is so pronounced that our builders (masons, etc.) seldom if ever haul sand for their mortar, but can almost every where, dig up all the sand they may need for ordinary work. —*Elwyn Waller, Morristown, N. J.*

SCHOOL BOTANY

THE LACK OF INTEREST IN NATURE.

It is now more than a quarter of a century since the first books on science designed to make the way smooth for the beginner appeared, and nearly as long since the sciences obtained a foot-hold in all representative high schools, but now, notwithstanding the fact that the generation which has taken charge of the world's work has had access to this literature, has been educated in such high schools, and has had such education extended in better equipped college laboratories than the world has ever seen before, the interest in nature or in science for its own sake seems not to have increased at all. In proportion to the total population, there were probably more botanists a hundred years ago than there are at the present time, and the same statement doubtless holds good for zoologists as well. We hear a good deal, nowadays about the movement "back to nature" but this is more a movement in suburban real estate fostered by the development of electric railways and automobiles than it is by the love of nature for her own sake. It is likely that a few enthusiastic devotees will continue to write books that attract only an accasional reader, edit magazines that have most meagre subscription lists and hope against hope that after labor enough has been expended the tide will turn and everybody take an interest in what they know to be a most interesting and attractive subject, but if the future may be judged by the past, they are doomed to disappointment. If they expect adequate results from their efforts they might better at once enlist as missionaries to the South Sea islands. When botany began to find a place in every reputable high school, it was expected that this would soon develop a vast army of plant lovers, but the expectation failed to be realized; in fact, it is the opinion of a good many who have carefully observed the proceedings, that one of the most efficient means of setting the student against botany is the average botanical course in the high school. The reason for this lies partly in the course itself and partly in the teacher. In most schools both teacher and student consider botany as a task—possibly not quite so irksome as geometry or latin but a task, nevertheless. The student is introduced to much pickled or dried material and many sections and disconnected parts of plants which he has never seen in nature from which he is *made to learn* a satisfactory number of facts upon pain of failure to "pass" in the study. The average teacher is prone to place discipline above interest, and a well filled note book above the power to see and to judge and the lessons are conducted upon lines that would do equally well for a class in ancient history. Nobody need expect much from the teaching of botany until it is taught out of doors by teachers interested in the work. The matter of interest upon the part of the teacher is one that those in authority commonly overlook. The classes in botany are usually turned over to anyone on the faculty who has not enough work in her own specialty to keep her busy. But even among those who teach botany by preference few are deeply interested in the subject. One who would know something of the botany of the region cannot rely for this information upon the teacher of botany in the high school. Generally speaking such teachers make no pretense to a wide knowledge of the subject. They read no botanical works, they subscribe for no botanical publications, they write no botanical papers, they make no original investigations; they are in a word, mere faculty members. If by some accident they attend a meeting of botanists they join the audience of mute and respectful listeners with nothing to say when discussion waxes interesting. How even the enthusiast can expect such an apology to turn out students with an abiding interest in, and love for, botany is beyond the comprehension of common mortals. What this country needs is more real botanists as teachers, easier access to nature, more encouragement of individual effort and less discipline for disciplines sake in the laboratory. When these ends are attained we shall hear fewer complaints that the public is not interested in the study of nature.

Dimorphic Branches.—The United States Bureau of Plant Industry recently issued a bulletin on "Dimorphic Branches of Tropical Crop Plants" in which it is shown that in cotton, coffee, cacao, banana and others there are two kinds of branches one of which produces fruit while the other is devoted to vegetative functions. In some species the fruiting branches rise from axillary buds and in others they are extra axillary. The fact that many plants bear two kinds of branches has long been known. In the pines there are not only two kinds of branches as regards function, but they differ as regards form and each bears a different kind of leaf. In the ginkgo the fruits are borne on certain dwarf branches, and similar dwarf fruiting branches may be seen in the apples, pears, plums and cherries of our gardens. Here they are called "fruit spurs" but they are none the less branches that are quite different in form from ordinary branches. They may often be only an inch long and yet a dozen years old. In the cotton plant the branches that arise from the axils of the leaves have purely vegetative functions while those that produce the cotton are developed from extra-axillary buds. For this latter style of bud the author proposes the term natal bud, possibly overlooking the fact that this type is well known as an accessory or supernumerary bud and is so discussed in all school courses. It is in no sense an adventitious bud but has a definite place at which to appear.

EDITORIAL

In the April issue of this magazine, we promised to have the present number out on time, little thinking that we would again have to give as a reason for delay that a fire had occurred in the printing office. Just a week after the April issue appeared, however, the ninth and final fire, now known to be of incendiary origin, completely destroyed the office. There was nothing to do, therefore, but to wait until new machinery could be purchased and installed, and issue the number as soon as possible. The fact that this last fire has been proven to be the work of a fire-bug makes it appear that the earlier fires with which we have had to contend, were due to the same cause. In the future, however, we expect to be exempt from such delays, since the printing company is now in an absolutely fire-proof structure isolated from other buildings of a combustible nature. The average editor thinks he has enough to do in getting his publication out on time, but a little variety has been injected into our program by three fires in one year and various other little annoyances among which was a dishonest postman, who for one whole subscription season waylaid the money that was addressed to us and got our accounts with subscribers badly tangled up in consequence. But we are still in the game and not only expect to stay in, but can say definitely, now, that in the not far distant future this magazine is to be increased to nearly fifty pages without any increase in the subscription price. We trust that our subscribers will overlook the present unavoidable delays and aid us in rolling up a subscription list that will make a larger magazine worth while.

* * *

Nearly forty years ago, Prof. H. H. Ballard of Pittsfield, Mass., founded a society designed to aid people of all ages in the study of nature. This society was named the Agassiz Association in honor of the famous naturalist, Louis Agassiz and for a quarter of a century it enjoyed great popularity. Thousands of people who now have an intelligent interest in nature, date the beginning of this interest from the time they became members of the Association. The society had been going a decade or more before the editor of this magazine was old enough to join it, but he still remembers with pleasure the broad and attractive vista into the out door world which it opened to him, and which has since only grown wider and more attractive with the years. With the advent in recent years of a multitude of books on all subjects pertaining to nature, the interest in the Agassiz Association has languished somewhat, but Dr. Edward F. Bigelow, of Sound Beach, Conn., has recently been attempting to revive it. He is now president of the Association and two years ago the way seemed clear for a realization of his ambition. A wealthy resident of Sound Beach, decided to give a plot of ground with necessary buildings to the Association, for use in carrying on its work. There was a string tied to this gift, however; if the Society failed to prove a success in two years the owner reserved the right to take back his gift. Dr. Bigelow accepted land and buildings with great joy, knowing that with such a start failure was impossible, but Dr. Bigelow's idea of success, it appears, did not co-incide with that of his whiloam benefactor. The latter, financially a success, was disposed to measure the success of others by the same standard and when at the end of two years, the society failed to show a good cash balance on the right side of the ledger, Dr. Bigelow was turned out of the eden he had created, forthwith. Not discouraged by this rebuff the indefatiguable Bigelow has started out to secure another and better home for the Association with apparently every prospect of success. A railway company has deeded to the Association more than an acre of forest land, and friends have already contributed upwards of two thousand dollars in cash for new buildings and equipment. More funds are necessary, however, for an adequate establishment of the work and Dr. Bigelow will be glad to receive additional contributions no matter how small. Everyone interested in the study of nature will wish, of course, to be represented in the undertaking by at least a small contribution. The object of the Association is one worthy of all encouragement.

BOOKS AND WRITERS.

Until very recently the origin of the flowering plants was shrouded in considerable mystery. Fossils that are very evidently closely related to modern species if, indeed, they are not identical with them, are not uncommon in the later rocks, but this series of specimens does not continue to the beginning and the task has always been to connect them with some of the older plant lines. Evidence that throws light upon this point, however, has rapidly accumulated during the past few years, and now the palaeobotanist is fairly certain of the main lines of descent, at least. It used to be thought, and is still taught in our schools, that the flowering plants originated from Algae by way of the mosses, and much study has been brought to bear upon the moss sporophyte in an endeavor to show how the fern plant could have arisen from it. The evidence of fossil plants, however, does not support this theory and it now seems more likely that the ferns and their allies originated directly from some forms of algae. After this gap is bridged over, there is still the hiatus between the ferns and flowering plants. This, botanists have often attempted to carry a line across by means of *Lycopodium* or *Selaginella,* deriving the pine cone from the fruiting parts of one or the other, and inferring the rise of true flowers by further modifications. It is now believed, however, that neither of these groups have given rise to any more modern branch, and that the club mosses and *Selaginellas* that we have at present have come down to us from remote ages, practically unchanged except as to size, numbers and a few bizarre points in structure. The ferns, hitherto regarded with little favor as the ancestors of flowering plants, are now considered as among the most likely species, especially since the discovery that many once regarded as true ferns, are really seed plants. The seed forming habit may have originated more than once, but it is a significant fact that ferns have been able to evolve it. The sago palms, or cycads, so fern-like in some respects, so seed-plant like in others, is now pretty generally regarded as the bridge between the ferns, and pteridosperms or "seed ferns" and the flowering plants themselves. The line of descent is supposed to lead through the Ranunculaceae or Magnoliaceae, whose reproductive parts are not so very different from those of certain fossil cycads. The pines and their allies are supposed to have arisen from the *Cordaites* an entirely extinct race of plants. According to this latest idea of evolution, the dicotyledons are supposed to be older than the monocotyledons, an arrangement that is the reverse of the belief held by many. This whole fascinating subject is taken up by a new book entitled The Evolution of Plants, by D. H. Scott, published by Henry Holt & Co. Dr. Scott is one of the foremost scientists in the study of fossil plants but has not forgot how to write lucidly and entertainingly as his little book shows. Those further interested in the evidence for the conclusion drawn will find them adequately set down in the book mentioned, which is published at 75 cents net.

For years, books on almost every conceivable phrase of natural history have multiplied, but the great bulk of our population is still densely ignorant of such matters. In time, if the flood of good books continues, we may hope to see the natural sciences take their rightful place in the estimation of the public and therefore, welcome every new book that appears, as another means to this end. Recently three different publishing houses have begun series of scientific books designed to interest and enlighten the general reader. The firm of D. Appleton & Co. are issuing a series of "Scientific Primers" under the editorship of J. Reynolds Green. Of this Series we have received the volume on "Biology" by Harvey Gibson and that on "Botany" by Green. Each volume covers about 125 pages, is well illustrated and discusses the fundamental principles of the subject of which it treats in a manner that must appeal very strongly to the beginner. The price is not given but it is probably less than 50 cents which brings the volume within reach of all who need them.

From G. P. Putnam's Sons comes a "History of Biology" by L. C. Miall one of the valumes is a "History of the Sciences Series." This is likely to prove an entertaining and instructive book to both zoologists and botanists since it gives an account of the origin and growth of the twin sciences of botany and zoology with the added merit that the information is in such compact form that the relationships of the two sciences are easily understood. After an introduction devoted to the biology of the ancients, the time since 1530 is divided into six periods and the development of biology in each is outlined. It is seldom that the botanist or zoologist has a clear idea of the history of his chosen science but this book will supply the lack. It is published at 75 cents net. Putnam's are also the American agents for the series of "Cambridge Manuals of Science and Literature," published by Cambridge University. We have already had the plasure of commending in these pages an earlier volume on "Plant Animals" and have now received "Plant Life on Land" by F. O. Bower. The reputation of Prof. Bower as a botanist is sufficient guarantee that the book contains interesting matter well presented. The ten essays that make up the book are largely ecological in character though the early pages have a thread of evolution running through them. The book has 150 pages and 26 illustrations and costs 40c net.

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The AMERICAN BOTANIST

Devoted to Economic and Ecological Botany

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THE MEADOW PHLOX.—*Phlox glaberrima.*

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Summer or winter, day or night,
The woods are ever a new delight;
They give us peace and they make us strong,
Such wonderful balm to them belong.
So living or dying, I'll take mine ease,
Under the trees, Under the trees.

—R. H. Stoddard.

THE SMOOTH OR MEADOW PHLOX.

By Willard N. Clute.

THE *Phlox* genus is a typical genus of the North Temperate Zone, but the American species are by no means evenly distributed nor do they all have the same general habitat. In the west there are several species that keep pretty close to the Rocky Mountain region, and in the east are others that are found only in the more elevated parts, while in the territory between are still others that come to their best development in the lowlands and on the prairies and become infrequent as the foot-hills on either border are reached.

The phloxes are practically absent from New York and New England but Florida possesses half a dozen or more species. In fact the region about the Gulf seems to be the center from which the various prairie species have spread northward. The migrations of the phloxes, however, do not appear to have been everywhere alike. The species that delight in warmth and sunlight have found the mountains north of the Gulf States to be a rather trying barrier between them and the prairies of Illinois and Indiana, but they have managed to go around them on the west by means of the Mississippi valley, while others have crept up along the Atlantic coast as far as Virginia.

One of the handsomest of the prairie species of the Middle West is the subject of our illustration, the smooth or meadow phlox (*Phlox glaberrima*). The species extends into Wisconsin in suitable locations and is everywhere one of our showiest wildflowers. This showiness is due quite as much to its profuse blooming as it is to its form and color. Unlike many another choice wilding it does not have to be sought in secluded glens, deep forests and other out-of-the-way places but spreads away in brilliant masses over meadow and prairie as far as the eye can reach, the most conspicuous plant in the landscape. The structure of the plant also contributes considerably to the effcetive display of its blossoms. The stems are slender, wand-like and long enough to lift the truss of flowers well above the grasses amidst which it grows, while the narrow leaves are, as it were, kept in the background and do not obscure the beauty of the plant by leafiness. As our illustration shows it is exceedingly abundant in favorable places. During its season of bloom few plants can surpass it.

NOVEMBER WAIFS.

By Dr. W. W. Bailey.

THE latest plant to bloom in our region, is the witch-hazel, (*Hamamelis*). Many weeds, not native, linger longer—even at times into December. They cannot legitimately be said to dispute the claim of witch-hazel; they know no better. It seems queer that the experience of some two centuries has not convinced them of the dangers and caprices of our climate. We might, indeed, inquire if, in that long time, they have not become acclimated, or acquired special mean to resist adverse conditions. Nothing can be more interesting than the study of environment. It is, as every one now knows, a potent factor in evolution.

But to return to *Hamamelis*. Its odd yellow flowers may still be found clinging to the nearly leafless boughs, the woody capsules do not mature till another year. They are natural machine guns, or may be, pistols, expelling their hard, shiny seeds as a fusillade of small shot. They go off with a loud report and are propelled to a distance of twenty or thirty feet, greatly surprising the collector, who, not knowing their war-like habit, takes them home.

Besides its medical use, wherein we may question it the solvent has not the greater efficacy, it has, from early years, been employed as a divining-rod to indicate hidden treasure and springs of water. The latter is found, we suspect, oftener than the former. Unless fate is especially malicious, the writer should now be a modern Monte-Cristo, for he has systematically (though without saving faith!), applied the usual tests to the twigs. The little grain of mustard-seed, some-how, finds poor accommodation in his cerebrum, but no doubt "the principle holds good."

Occasionally we notice a few plants of the autumn crocus (*Colchicum autumnale*) in gardens. It is unlike the spring crocuses of the lily family. It bears the English name of "Meadow-saffron," and has long been used for its potent medicinal properties in gouty and rheumatic difficulties. Lindley says, "It has no claim to be considered infallible," a saving clause. The writer is still looking for the medicine that will fill that bill for rheumatism!

Very handsome late bloomers are the Japanese anemones, growing two or three feet high, and bearing pink or white blossoms two to three inches in diameter.

Of course cosmos should not be forgotten, nor certain hardy chrysanthemums. Both belong to that vigorous, aggressive race, the *Compositae*. Two species of *Cosmos* are seen in cultivation and both are grown in Mexico. In favorable seasons they grow to an astonishing height, and bloom very late, their white or rose-colored heads suggesting even when quite near, the flowers of *Sabbatia*. They are, however, in no way related.

These fine plants are apt to delay their blooming too long and get caught by frost. In other years they run entirely to foliage—so they cannot be considered wholly satisfactory. However, like the horrid little girl, they are becoming better. One cannot now forecast their probable place in floriculture.

Providence, R. I.

ASTERS.

By B. O. Wolden.

THERE is a peculiar charm about the last flowers of the season. When we go for a walk on a September day we know that not many days are left us to see and admire. When we think of autumn flowers we have in mind, probably more than any others, the wild asters which are so plentiful at this season. During the last days of September and first part of October, our woodlands and prairie roadsides, when left undisturbed, are clothed in blue, violet and purple by these flowers. Occasionally we see a hillside which seems snow-clad, when the white dense flowered aster is at its best.

We welcome and love the flowers of spring but with them are associated the thought that they are only the beginning, there will be more flowers coming. But when the asters come we take notice. The season of flowers will soon be over and we bid them welcome almost with a sigh.

But because they are the last we love them the best. When the leaves turn to red and gold and are scattered over the ground, when the autumn rains fall and the wind blows cold, the asters bloom in all their glory, fresh and fair. It seems to us that the following lines from Bryant's "To the Fringed Gentian" might be used in speaking of the aster also.

"Thou comest not when violets lean
O'er wandering brooks and springs unseen,
Or columbines in purple dressed,
Nod o'er the ground bird's hidden nest.
Thou waitest late and comest alone
When woods are bare and birds are flown,
And frosts and shortening days portend,
The aged years is near his end."

It may be that the aster does not wait till all the other flowers are gone before it makes its appearance, but it stays later than the other autumn flowers, and at least the smooth aster of the prairies and the wood aster lingers long after the golden rods and the sunflowers have said farewell.

If we go for a walk in the vicinity of the writers home we may get acquainted with many beautiful species. In the woods we find the blue wood aster (*A. cordifolius*) which, though it may not be as showy as some, is very pretty. But the kind that will probably first catch our attention is the New England aster (*A. novae angliae*) which, while being abundant on the prairies is also found along borders of woods and wooded roadsides. This, our largest flowered, is also considered by some, our handsomest species. Whatever difference of opinion there may be in regard to this, in speaking of the common form with violet-purple flowers, it is hard to deny this distinction to the form with rose-colored heads (var. *roseus*) which however is of rare occurrence at least in this vicinity. Another species that we may find in low open woods and thickets is the purple stem aster (*A. puniceus*) with rather large, pale lilac-blue or almost white flowers. Before we leave the woods we must also look for the starved aster (*A. lateriflorus*). This has rather small white or bluish heads. In low ground we find the panicled aster (*A. paniculatus*) with white flowers and leaves resmbling those of the black willow. A rarer and handsomer species is the amethyst aster (*A. amethystinus*) with blue heads also found in rather low ground.

A very conspicuous plant is the previously mentioned dense-flowered aster (*A. multiflorus*) which is usually abundant on high prairies. The heads are small but very numerous and crowded on the branches. A most beautiful species is the silky aster (*A. sericeus*) easily distinguished by its silvery silky leaves. The flower-heads are described as purple-violet. This is found on high prairies as is also the aromatic aster (*A. oblongifolus*) another handsome species with purple heads.

Although I have left it for the last I think that long before this our attention has been drawn to the beautiful smooth aster (*A. laevis*). This elegant species with smooth leaves and stems, and flowers which have been described as blue-violet, but which are often sky blue, certainly is an ornament to our high prairie roadsides, where left unisturbed by the mower, cheering the heart of the wanderer during the haleyon days of October.

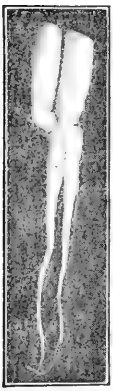
Wallingford, Iowa.

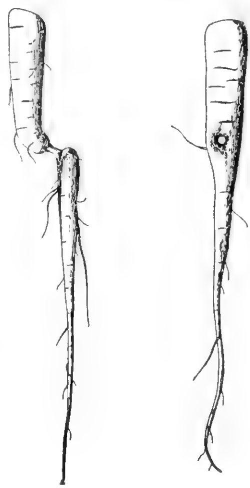
TASTE OF POISON IVY.—Looking over some numbers of *The American Botanist* I find in the February number for 1903 a short article on the taste of poison ivy by a lady who had tasted of the bark, also a note by the editor telling of a man who ate of the leaves. The editor desired to know the results of experiments by others, and though the matter was very likely discussed at that time I wish to add my experience. Having always been immune to poison ivy I have handled it without thought of harm and as a boy I have rubbed the leaves on my hands and face to show that the poison did not affect me. Later I have chewed the leaves and tasted the bark, which by the way has a spicy taste, and never experienced any unpleasant results. I know many people, who, while they seem to be proof against the ivy, would hardly care to test it in the above mentioned manner.—*B. O. Wolden, Wallingford, Ia.*

ROOT PUNCTURED BY ROOT.

BY PROF. CHARLES E. BESSEY.

CAN one root puncture another is the question which is suggested by the illustrations shown here. These two radish roots which came from a garden in Lincoln grew side by side and in some way one has managed to grow directly through the other. The first figure indicates that the one on the left has punctured the one on the right and then continued its downward course. This surmise is shown to be correct by the second figure where by splitting one of the roots the two were separated. In the right-hand root is seen a round smooth hole with no indication whatever of any rupture of the tissues. The epidermis is apparently continuous through the hole, and there is no sign of decay, or even of a roughening or cracking of the surface. The left-hand root bends abruptly, and then is suddenly much constricted where it passes through the hole, below which it is greatly enlarged again, and sharply bent downward. The constricted part is smooth and shows no sign of decay or injury.





It was my intention to make a thorough histological examination of these roots in the hope that it might throw some light on how one bored through the other, but the matter was crowded aside, and it is now too late to do so. The case is published in its present form in order to direct attention to structures of this kind. It is likely that more examples may be found by inquiries of market gardeners.

The University of Nebraska.

NOTE AND COMMENT

WANTED.—Short notes of interest to the general botanist are always in demand for this department. Our readers are invited to make this the place of publication for their shorter botanical items. The magazine is issued as soon as possible after the 15th of February, May, August and November.

FRAGRANT COREOPSIS.—Comparatively few of the composites are fragrant. Though many possess abundant nectar it seems to be a family characteristic to depend upon color, rather than upon odor, for the attraction of insects. A good many species, however, have a not unpleasant smell, such as is found in the garden sunflower, but in a common species of coreopsis (*C. tripteris*) this rises into a distinct and agreeable perfume like that of the wild crab. The odor does not appear to exist in every clump of plants, but the fact that it exists in some is sufficiently note-worthy. No doubt a race of plants in which the perfume is strongly accentuated could be bred up from such specimens, and since the fragrance of wild crab is universally appreciated, such plants would probably find a ready sale.

YELLOW-STEMMED DOGWOOD.—Several species of dogwood (*Cornus*) are extensively planted in parks and other public grounds, for the cheerful effect of their deep red stems in winter. One of these is a native species, *Cornus stolonifera*, and others are found in the Old World, notably *C. sanguinea* and *C. mas*. The color of the stems is due to a substance variously known as anthocyan, and carotin and it is this same substance that gives the red orange or yellow color to many fruits. This being so, it is not surprising to find in the catalogues of dealers, many yellow-barked forms which bear the same relation to those that are normally red-barked that yellow berries do to red ones. The difference in color seems due principally to a diminution of anthocyan in the less deeply colored specimens. The yellow form of our familiar red osier is *Cornus stolonifera lutea.* The equally well-known winterberry which affects habitats similar to that of the red osier has a form known as *Ilex verticillata lutea.* In the latter case, however, the term *lutea* refers to the color of the fruit which is yellow instead of red. Just as one may predict the finding of albino forms of all colored fruits, so one is warranted in expecting yellow forms of red or black fruits and possibly melanitic or black forms of those normally red or yellow.

A PAINT EATING FUNGUS.—Everywhere the fungi are busy tearing apart the compounds formed by other organisms. In sugary solutions the yeasts break up the sugar into carbon dioxid and alcohol and we call it fermentation; in milk, bacteria make lacitc acid of the milk sugar and we call it souring; in many food products the structure is broken down by various fungi and we call it decay. The mouldering log in the forest, the rotting fruit under the trees, the leaves, straw and other refuse plowed under by the farmer—all are slowly turned back by fungi into the elements from which they were formed. Despite the wide range of substances upon which fungi feed, we would scarcely consider paint as a likely substance for their uses, but a recent *Kew Bulletin* gives a colored plate of a fungus that delights in fresh white paint in which it forms rosy dots and blotches. It is most common in hot-houses where the warmth and moisture conduces to its growth. In a single range of houses, it is said to have recently caused a loss of nearly a thousand dollars by ruining the paint. This strange fungus is named *Phoma pigmentivora.* It is not alone, however in its predilection for unusual food substances. The common blue mold often fancies writing ink and sometimes penetrates the shells of eggs. In the laboratory many stains and other reagents are attacked, among which may be mentioned solutions of acetic acid, glycerine and eosin.

VALUABLE TREES.—The wayside trees were once considered of no especial value and to be hacked and crippled by the general public at will. Horses gnawed them, telegraph and telephone linemen butchered them, patent medicine sellers used them for bill boards and everybody else misused them whenever it came handy. But times have changed and conservation is coming to be applied to even street trees. According to *Gardening* the borough of Conshohocken, Pa., chopped down twenty-six maple trees belonging to William Hallowell in order to widen a street whereupon the owner brought suit and was awarded $4,860 damages. Laws in each state differ somewhat as regards the amount one can recover for trees injured but it is safe to say that a few cases like the above will make the citizens in some parts of the world begin to take notice.

BIDENS BECKII.—At the head of North Main street, in Concord, N. H., there is a pond in an old river bed called from its shape horseshoe pond. To me the flora is exceedingly interesting. It includes much pickerel weed, the fragrant white pond lily, the spatter dock (*Nuphar advena*), *Nais flexilis* for which Gray gives us no credit, a species of chara, probably *foetida,* the floating heart, different species of *Potamogeton* and the common bladderwort (*Utricularia vulgaris* var. *Americana*). But perhaps the rarest find is the water marigold (*Bidens Beckii*). In looking over the mass of vegetation washed up in autumn along the edges of the pond I have found for several years a section of a plant with divided leaves resembling those of some species of bladderwort without the bladders. The identity of the plant was a problem most annoying until some sharp-eyed observer found the water marigold in flower. This curious bidens manages to adapt itself to the three elements, earth, water and air. Rooted in mud it lifts a long stem bearing many capillary leaves through the water to the air. Here the character of the leaves suddenly changes and they become thick, lanceolate and merely toothed. The main stem and its very few branches terminate in the typical blossom of bur marigold. The seventh edition of Gray's Manual gives the range of *Bidens Beckii* as from Maine and Quebec to New Jersey and westward.—*Miss S. F. Sanborn, Concord, N. H.*

CULTIVATING TRAILING ARBUTUS.—The trailing arbutus (*Epigaea repens*) has a well deserved reputation for being difficult to establish in cultivation. Although it is most abundant in thousands of square miles of woodland and hilly pasture, often thriving in the most inhospitable surroundings, it has heretofore refused absolutely to grow when removed to better quarters in the same general region. A legend has even grown up about it to the effect that the Indian named it the one plant which the white man could not tame. A few people, it is true, have succeeded in domesticating it, and have taken great credit to themselves for the accomplishment, but now that the secret of growing it is out, their success is seen to have been merely a lucky accident. When one knows how, the culture of this plant seems absurdly easy. This was discovered a short time ago by F. V. Coville a government botanist. All one has to do is to cultivate the plant in an acid soil. The arbutus, like the heaths in general, cannot endure lime in the soil and just as soon as the soil loses its acid character begins to fail. Poorly aerated soils are usually sour soils and this gives the clue to the fondness of heaths for swamps and bogs. Variou conditions unite to make some upland soils acid also, and whenever, heaths are found away from the bogs they are to be expected in such soils. Such success has attended Coville's green house experiments that plants grown from seed have bloomed the second year with flowers seven eighths of an inch across. In transplanting arbutus care must be taken not to disturb the roots much, else it will injure the fungus that lives on them.

Trees Injured by Woodpeckers.—From a recent report of the National Department of Argriculture, it appears that a single species of woodpecker attacks no less than 246 species of native trees and 31 introduced species. This bird is the yellow-bellied sapsucker (*Spyrapicus varius*) a familiar figure about the trunks of trees at the time the buds are bursting. As its name indicates the bird is fond of the sap of trees and times its migrations northward in accordance with the sap-flow. It is its custom to sink a series of pits through the bark and into the cambium of several trees near together, and then to spend the hours in making the rounds of these wounds and sucking up the sap. The same trees are visited year after year, until in some cases, the bark is pretty thoroughly pitted. Good illustrations may often be found in old apple trees. Frequently such attacks result in permanent injury to the trees but many species seem able to thrive in spite of them. When the wounds quickly heal up, as they usually do, there is formed a curious twisted condition of the woody fibers which makes that peculiar effect called bird's-eye. Whether all bird's-eye wood is due to this cause does not seem to be known.

Linnaean Trinomials.—Those who do not delve deeply into the history of botany have the idea that Linnaeus was the first to substitute two Latin or Greek words for the string of descriptive terms that earlier stood as the name of each species. It is true that to Linnaeus we are chiefly indebted for emphasizing the fact that two words are quite sufficient in the designation of any species, but it is also true that authors before his time sometimes used but two. The facts in the case seem to be that the opinions upon this point were gradually crystallizing about the time the works of Linnaeus appeared and he consequently gets credit for rather more than he deserves in this line. It will be a surprise to many to learn that Linnaeus himself did not always stick to two names for a species. The editor of the *Midland Naturalist* has recently given a list of more than a hundred plants to which Linnaus gave three names. Some of these are still in use as for example *Capsella bursa-pastoris, Smilax bona-nox, Panicum crus-galli,* and *Opuntia Ficus-Indica*. The hypersensitive manual makers, have avoided the appearance of using three names by hyphenating the last two but the fact remains that they were three words in Linnaean works and we have no reason for assuming that they are not three now.

Moving the Tiger Lily.—On the 17th of last June, I transplanted a specimen of *Lilium tigrinum* from my yard to that of a neighbor's. The plant was then about two feet and a half tall and had begun to develop flower buds. I did not look for success, but the serenity with which the plant took its change of habit was perfect and struck me as something remarkable. Not a bulblet dropped and the plant went on growing and developed the buds in the most natural way. A great amount of energy must have been stored in its large white bulb and fleshy rootlets, don't you think?—*Miss S. F. Sanborn, Concord, N. H.* [Nearly all of the bulbous plants are remarkably forehanded, if we may speak thus of a plant. They often store up so much food that they are able to bring their flowers to maturity without further demands upon the outside world. A few weeks ago, we saw a basket of autumn crocus in the stock of a florist, that had burst into flower though left on a dry shelf in the dark and some of the arums are famous for blooming from a dry bulb without requiring water. Hyacinths, Chinese lilies, narcissus and others have sufficient food for this process but must be given water in order to complete it.—Ed.]

Rosette Plants.—Late in fall and early in spring the rosette plants are most conspicuous. Even the casual rambler does not fail to note the multitudes of plants with their leaves disposed in circles and closely pressed to the earth. It is customary to assume that plants adopt this form in order to give their leaves the maximum amount of illumination, and, in fact, this end is secured when the plants grow in open places where plenty of light is available. In woods and other shady places, however the rosette plants are either rare or absent. Notwithstanding all this, there may still be other reasons why the rosette form is a useful one to the plant. Plants, as we know, need carbon dioxide for food-making. This gas is never abundant in the air, but owing to its weight it is more plentiful near the surface of the earth than elsewhere. Under such circumstances the rosette plant clearly has the advantage over taller species. Again the rosette habit is a protection from injury by animals and storms, and in winter such plants are protected from sudden changes of temperature by being covered with snow and dead leaves. As a matter of fact, it is likely that many other plants would find it advantageous to be rosette plants were it not for the struggle for light that must be maintained.

Dominance of Flowering Plants.—Everybody is aware that flowering plants are the dominant race but we seldom realize how completely they have taken possession of the earth. Mosses may form the main covering of some cold wet areas in the north and ferns may occupy certain sterile regions almost to the exclusions of everything else, but even here, a few flowering plants creep in. In the desert, flowering plants alone, are at home, in the water other species are as completely adjusted to environment, and a few actually inhabit the ocean, a region in which no moss, fern or conifer dares venture. In looking for the reason for such diversity of form and habitat, it seems scarcely too much to attribute it to the offices of insects. That such insignificant factors as insects could have lifted the seed plants up to the highest point in plant evolution, does not seem improbable upon careful consideration. So long as plants were aquatic, the male elements could reach the eggs by swimming, but when plants ventured out on land some other method of transferring the fertilizing bodies had to be devised. The simpler species therefore, came to depend upon the wind for this purpose, but the higher plants entered into partnership with insects to the advantage of each.

Catapult Seeds.—Those who stick pretty close to systematic botany are likely to think that family and even generic likenesses are pretty closely confined to the flowers and fruits. In reality a distinct plant family may have a large number of other resemblances some of which may even be internal as in the case of the production of inulin instead of starch as a reserve food, in some groups or a particular form of color for the flowers in others. Methods of seed dispersal tend to run through entire plant families and sometimes extend to allied orders. All the geraniums, for instance have some method of slinging their seeds, and similar methods of seed dispersal are found in the Oxalidaceae and Balsaminaceae. The not distantly related Violaceae also propel their seeds. Curiously enough each family mentioned secures the same end by a different method. The geraniums are the only ones that use a sling for the purpose. The oxalises turn the ripened pod inside out with a jerk, the pods of the balsams, as in the well-known touch-me-not, fly to pieces at the slightest jar, while those of the violet slowly contract pinching out the seeds one after the other as children sometimes shoot watermelon seeds by pinching between thumb and finger.

Leaf Adjustment in Oxalis.—The oxalis is the real sensitive plant if by this we mean a plant so delicately balanced between light and shade that a small change in the intensity of either will cause it to make new adjustments of its leaves. The plant is reported to have four ways of adapting its leaves to the light. As in most plants it can move the whole leaf, and in addition the single leaflets may vary their position. It is well known that these latter close at night, and may even do so in the presence of too much heat. Within the substance of the leaf two other adjustments may also take place. In one the chlorophyll grains are able to change their position in the cell. When light becomes too intense they migrate to positions close to the cell wall where they are in a measure protected by it. Should this not afford suitable protection the chlorophyll grains or chloroplasts change their shape and thus avoid the light rays. According to Sachs, if the oxalis plant with folded leaflets is covered at night, so that no light can penetrate to it, it will nevertheless spread its leaves the next morning whether the cover is removed or not. This seems a rather improbable statement and some of our readers who hail from Missouri might investigate for themselves. The oxalis is a weed nearly everywhere.

Decorative Saltbushes.—About the time the World's Fair was held in Chicago, plantsmen began the introduction from Europe of a trim little plant of the goose-foot family under the name of standing cypress (*Kochia scoparia*). This was used in some of the plantings at the fair and in consequence is frequently known as the World's Fair plant. The plant is much like a small cypress in appearance and as it turns bright red in autumn it is often used for hedges though it is an annual that must be replanted yearly. According to a government bulletin received recently we do not need to go to Europe for plants of this kind. In the semi-arid west there are several members of the same family though of a different genus (*Atriplex*) that are extremely useful for hedges and they have the additional qualification of being able to grow in alkali soils. This last feature gives them their common name of salt bushes. In Santa Barbara and other cities on the Pacific Coast their use for hedges has become general. The species most used is *Atriplex Breweri* an evergreen shrub of compact growth but several other species may be used instead. All have the ability to withstand heat, cold and drouth and are very desirable for prairie regions.

SPRENGEL AND POLLINATION.—Sometimes the merest trifle has served to turn the attention of great minds into new and important channels. It is said that Asa Gray became a botanist from having his attention attracted for a moment by the spring beauty (*Claytonia*). In a similar way Christi n Conrad Sprengel was started upon his brilliant investigations into the relationships of flowers and insects by the contemplation of the hairs on the petals of *Geranium sylvaticum.* He argued that the great Creator would have made nothing in vain and therefore that even these tiny hairs must be useful. Sprengel was a good Darwinian, if we may use that term of one who died long before the "Origin of Species" was issued, and though we now know that many plant structures are of no use to the plants that possess them, we may rejoice that Sprengel held the views he did since it resulted in our first real knowledge of the pollination of flowers by insects.

PERFUME AND THE COLOR OF FLOWERS.—It is stated on the authority of a German botanist who has been investigating the subject that out of forty-three hundred species of plants cultivated in Europe only four hundred and twenty have an agreable perfume. As has long been understood, flowers with white or cream-colored petals were found to be most frequently fragrant after which come those with yellow, red, blue and violet petals in the order named. Only thirteen violet colored flowers had perfume, but this is partly due to the fact that such flowers are not abundant in any flora. Of the total number of flowers examined, twenty-three hundred had no perceptible odor of any kind. This does not mean that they have no odor, but simply that they have no odors that man can detect; many of them may be fragrant to insects and probably are. More than three thousand of the flowers examined had disagreeable odors of various kinds, but these, again, did not seem to be disagreeable to the insects but on the other hand were often attractive.

Experiments with Elder-berry.—There are various substances known which may be used as a test for acids and alkalis, turning one color in the presence of an acid and another in the presence of an alkali. The most commonly used agent in this work is litmus paper made by soaking paper in a solution of litmus derived from a species of lichen. When blue litmus paper is dipped into an acid it at once turns pink, and when dipped into an alkali it turns blue again. These changes may be kept up indefinitely. A similar color change may be produced in the juice of the common elder-berry. If a few drops of vinegar or other acid be added to it, it turns a deep pink and if soda or some other alkali is added to it, the pink disappears and a blue color takes its place. Indeed, this curious change of color seems dependent upon similar conditions throughout plant life. A red geranium or other red flower may be made blue by immersing in ammonia or any strong alkali or turned back to red by an acid.

Meaning of Amaryllis.—I do not quite agree with the explanation given in the *Botanist* that the word *Amaryllis* comes from the Spanish word *amarillo,* meaning yellow. In looking up the matter, I find that Linnaeus gave the name to the group of plants called by Tournefort, Dillenius and other pre-Linnaeans by the name, impossible under Linnaean rules, *Lilio Narcissus.* I say the name is impossible, because that author would not tolerate two-worded generic names. In the "Genera Plantarum" of 1737, he therefore changed the older binary to *Amaryllis,* and first described several species under that name the same year in that remarkably exact work of his, "Hortus Cliffortianus," written during his sojourn in Holland with George Cliffort in whose botanical garden and greenhouse he found several plants of the genus in question. At the end of the description in this latter work he says: "*Lilio Narcissus vocabulm est confarcinatum quod rejicio. Flores hujus generis eximii sunt, nescio num 2da parem habet, hinc Bellae donnae nomine transiit in proverbium de omni grato, et de secunda specie apud Hortulanos quosdom quae cum et radice amara sit pro Amarella, Amaryllis.* In the "Philosophia Botanica" Linnaeus was called on to make his apologia for the changes he made and he explains there many derivations of words which our modern Manual makers have badly misinterpreted. He himself, however, sometimes makes mistakes as in the case of *Sedum.* On page 170 he says: "*Nomina generica poetica, Dearum ficta, Regum concerata, and promotor um Botanices promerita retineo.*" In this list of poetical names given in honor of mythological persons and deities also promotors of botanical science he has the word *Amaryllis.* It was for this reason, then, that Alphonso Wood that ardent and clever American botanist and also A. Gray in his earlier works had under *Amaryllis* the words "Dedicated to that nymph." Taking these several quotations in connection we see that since Linnaeus, as he says in the "Hortus Cliffortianus," must reject the name *Lilio Narcissus* of the older botanists, and since the flowers of the 'second plant he describes (i. e. *Amaryllis Bella donna*) are so remarkable that they have no equal and have been called Bella donna (i. e. "beautiful lady"), hence all were called Bella Donna. The Bella donna of Vergil had passed into proverb as significant of every good gift and since of the second species (i. e. *Amaryllis Bella donna*) the roots are bitter for the word *Amarella* (diminutive of "the bitter one") we may use *Amaryllis?* The words of Linnaeus speak for themselves. In general where the author gives a new name or applies an otherwise obscure one he always explains somewhere, or at least apologizes for his inability to explain name derivations. We may say too that if our very recent botanical name-tinkers looked into that gem of a book the

"Philosophica Botanica "of Linnaeus they were likely to learn a few things worth while along many other lines of nomenclature. Another question that might be brought up here is that the above discussion seems to point to the fact that since the genus *Amaryllis* received its name because of the character of the plant called *Amaryllis Bella donna*, this plant is to be considered the type of that genus. This is worthy of note since some one has pretended to separate from the genus this type itself thereof under the name *Coburgia Belladonna.—J. A. Nieuwland, Notre Dame, Ind.*

BLUEBERRY CULTURE.—The blueberry is the latest of the promising fruits to be brought under cultivation. Up to the present the vast quantities of blueberries and huckleberries that have annually appeared in the market have come from plants growing wild on mountain sides or in bogs. Efforts to cultivate them commercially have thus far resulted in failure and in consequence little could be done to propogate the more desirable varieties. It now turns out that all the plant needs, in order to grow luxuriantly is a soil in which lime is lacking. Given this and it seems to thrive as readily as any other crop. The whole heath family, to which the blueberry belongs, is very intolerant of lime and the species are usually absent from lime stone regions. If they do occur they are invariably in bogs or other situations where the soil is sour. Such soils not only lack lime but are deficient in nitrogen, also, this latter a most important element in the economy of all plants. The blue-berries, however, get around this difficulty of a lack of nitrogen by means of a fungus upon their roots with which they have formed a partnership. This fungus is able to take nitrogen from decaying organic matter, and thus the plants are supplied. It is likely that the discovery of the blueberry's requirements will revolutionize the handling of this crop. Swamps that have heretofore merely taken up room on the farm may now be made to become most profitable pieces of property.

Bees and Red Clover.—It scarcely seems possible that a difference of less than an eighth of an inch in the length of a bee's tongue could increase or diminish the hay and honey crop by hundreds of tons, but this is exactly what occurs annually. There is an immense amount of honey stored in the long tubes of the red clover and other plants, which the honey bee cannot reach and so this crop goes ungathered. But the bees and bee keepers are not the only losers. If the honey bees were able to get honey from red clover blossoms they would of course, work on them with the result that the blossoms would be more extensively pollinated and therefore produce more seeds. Since hay is sold by weight, every extra pound of seed is so much gain to the farmer. The problem that now confronts the agriculturalist is how to adapt flower and insect to each other. This can be accomplished either by breeding a race of bees with longer tongues or a race of clover with shorter tubes. The farmer anxious for an increase in the clover yield would prefer the latter method, but the bee-keeper would prefer to lengthen the tongues of his bees, since thereby they would be able to glean from other flowers from which they are now excluded by their short tongues.

The Function .of Pollen.—"The fertilisation of flowers" and the significance of pollen, as the male fertilising element, was quite unknown until a little over two hundred years ago, when it was discovered by one Nehemiah Grew (who was in 1677 secretary of the Royal Society of London) in the old Physick Garden opposite Magdalen College at Oxford. Seventeen years later it was placed on a sure footing by the experiments of Jacob Camerarius, who proved that "seed" does not become fertile unless fecundated by pollen. It is a singular fact that the ancients had no conception of the existence of male and female reproductive particles in plants. They seem to have regarded "pollen" as meaningless dust. Aristotle expressly declares that plants have no males and females, though he says he knew some facts which led him to conclude that some trees "aid" others in the production of fruit, as in the case of the fig-tree and the capri-fig. The ancient Egyptians and Assyrians, as we see by their sculptures, knew and practiced artificial fertilisation of the date-palm. Aristotle's pupil, Theophrastus, entertained the notion that this was similar to the sexual process in animals, but dismissed it on the ground that such a process could not occur in one kind of tree only, but would be found in many or all plants, if it occurred at all! Long after him the Roman country gentleman, Pliny, stated his belief that all trees, and even herbs, have two sexes. But this well-founded view did not receive any support among philosophers and naturalists. The authority of Aristotle gave prevalence to his mistaken view for many centuries. Grew's observations at the end of the seventeenth century, which were confirmed and extended by other botanists, were actually the first discovery of the sexuality of plants.—*From an article by Sir Ray Lankester.*

Advantage in Stirring the Soil.—In loosening the soil (cultivating) along the rows of beets, carrots, etc., it has seemed to me that another purpose than those usually intended, is served. Apparently the operation also breaks up the runways of various "bugs" that live underground and attack the plants by night or day according to their habits. By "bugs" I mean in general all forms of insect life against which one has to wage war in a garden patch. So, even if the soil is quite loose on the surface, a stirring of the soil seems to diminish perceptibly the raids of those enemies—*Elwyn Waller, Morristown, N. J.*

Gardening.—The love of dirt is among the earliest of passions as it is the latest. Mud pies gratify one of our first and best instincts. So long as we are dirty we are pure. To own a bit of ground, to scratch it with a hoe, to plant seeds, and watch their renewal of life—this is the commonest delight of the race, the most satisfactory thing a man can do. When

Cicero writes of the pleasures of old age, that of agriculture is chief among them. To dig in the mellow soil—to dig moderately, for all pleasures should be taken sparingly—is a great thing. One get strength out of the ground as often as one touches it with a hoe. Antaeus was no doubt an agriculturist and such a prize fighter as Hercules couldn't do anything with him till he got him to lay down his spade and quit the soil. It is not simply potatoes and beets and corn and cucumbers that one raises in his well-hoed garden; it is the average of human life. There is life in the ground; it goes into the seeds; and it also, when it is stirred up, goes into the man who stirs it. The hot sun on his back as he bends to his shovel and hoe, or contemplatively rakes the warm and fragrant loam is better than much medicine.—*Charles Dudley Warner.*

THE LIVING SOIL.—The facts that go to prove that the soil is not an inert mass of rock particles are steadily increasing. The longer we study the humus, the decaying particles of vegetable matter without which no soil can be fertile, the greater becomes the list of animal and plant forms inhabiting it. Here we find organisms that store nitrogen in the soil and others that remove it, organisms that turn the starch in fallen leaves into sugar to be reabsorbed by the plant, organisms that produce the nodules on the roots of legumes, organisms that sustain other symbiotic relations with the higher plants and still others that prey upon all the others. Once it was thought that the fertility of the soil depended upon the amount of certain minerals in it; now it seems probable that there is sufficient minerals for many crops and that the determining factors in fertility are these lowly members of the plant and animal kingdoms.

SCHOOL BOTANY

MONOCOT AND DICOT STEMS.—The good botanist is usually so familiar with the structure of monocot and dicot stems that he may fail to present the subject clearly to students through failure to appreciate their point of view. Care must be taken to select typical examples. To compare, for instance, a piece of asparagus with a basswood twig is misleading for one is an herb and the other a woody plant. Possibly the best way of approach would be the comparison of the stem of the cat brier (*Smilax*) with a twig of any common dicot tree or shrub and to follow this up with a comparison of such a plant as the bamboo with that of the elder. Asparagus or corn, usually studied are only properly compared with such dicot stems as those of geranium or begonia. The reason the comparison of, say, the cornstalk, with the woody dicot stem is not successful, is because the pupil is likely to assume the hard outer portion of the monocot to correspond either to the wood or bark of the dicot, and thus miss entirely the significance of the scattered bundles.

CHANGING NAMES.—"Why should any man, even though a profound scholar familiar with the intricacies of his own field, so far forget or minimize the difficulties of the long way by which he has to come, as to be willing to leave the path harder for the next comer" queries the veteran zoologist, J. G. Needham in *Science*. Well, this is an easy one. The profound scholar, the scholar lacking profoundty and the plant student so lacking in scholarship that he doesn't even know what profundity means, are alike resting under the impression that to do something in science one has only to undo or change something that another has done. This is not entirely a modern vice. We have long had three words to characterize the same idea in floral structure, namely, gamopetalous, monopetalous and sympetalous or polypetalous, choripetalous and eleutheropetalous. While two words for the same thing are common witness endosperm and albumen, caulicle and hypocotyl, and the like. Those botanists that work with the fungi have recently contributed their share to the confusion by injecting into nomenclature the words telia, pycnia, aecia and uredinia with their relatives teliospores, aeciospores and urediniospores. The fact that we had uredospores, teleutospores and aecidiospores before these scientists were born did not deter them. What matters it to them that the student in both school and college will be bothered by the change? The new way is so scientific!

A Good Seed for Study.—Throughout the winter, in almost any locality, there is to be found one of the most illustrative seeds that can be given the beginner for study. This is the seed of the honey locust (*Gleditsia triacanthos*). The long, flat, twisted pods of this species, dark red in color, hang on the trees until nearly spring and later may be found on the ground in the vicinity. The seeds are of especial value from the fact that they contain an embryo, whose parts are easily recognized, together with endosperm arranged in a very simple manner just within the testa. With other common seeds the difficulty is to get one that will show all these parts plainly. Most seeds with endosperm have very rudimentary plunnules. This is true of the castor bean, four o'clock morning glory and other seeds commonly taken for study. It is not suggested that the honey-locust should take the place of these,—rather that it should precede them in the study in order that the pupil may be made familiar with a seed having a complete embryo and endosperm. Then the others may be given, though morning glory seeds are too small for good work with beginners. The honey locust also illustrates the fact that the testa may be so hard as nearly to exclude water. For class use they must be boiled for ten minutes or more to soften and swell them. If one prefers to purchase the seeds they may be obtained of most seedsmen, but it is easy to collect a supply that will last for years.

MAKING A BOTANY TEACHER.—Commenting on the fact that botany in the high school is usually entrusted to the teacher who has the least to do, a professor in a well known university writes as follows: "I have had some remarkable examples called to my attention of just what you mention, namely the assignment of botany to anybody. A few years ago a graduate of this University, a young woman of marked ability, who had studied absolutely no botany whatever, and who was appointed a teacher in one of the high schools of the state, came to me in great distress in August after the close of the University Summer School saying that she had been informed that she *must* take botany as one of the subjects that she should teach. She protested saying that she had applied as a teacher of English literature, history, etc., and that she knew nothing about botany. Her protest was passed over as of no value and she was informed that she must either give up the position or teach the botany. Now what do you think of that? The young woman had the good sense to see that she could not teach botany without knowing something about it. She came to me and I gave her a place in my laboratory during the rest of the vacation and gave her all the help that I could. Being a young woman of much abiliy she mastered the essentials of the subject to such a degree that she became one of the best teachers of botany in the high schools. But this was an exceptional case She has ever since then felt indignation against the school authorities that compelled her to do this and yet with this has been the feeling of pleasure that after all it brought her into a subject that she liked very much. She is not teaching now, but has gone into medical practice, but the case is interesting and quite to the point."

A SIMPLE METHOD OF GROWING ALGAE.—It may interest teachers who have no aquaria at hand to know of a very simple and successful method of growing algae for class use. Glass jars of almost any kind can be used although those with large tops such as battery jars are more convenient. Even ordinary fruit jars give good results. The jars are set on the window sill and into them is put water containing algae. There should be water enough to fill the jar from one half to three fourths full. A piece of window glass of suitable size and shape is placed over the top for a cover. In such aquaria algae grow rapidly and need no care except the adding of a little water once or twice a year. If in the fall a number of jars are filled with water from various ponds and streams containing algae it is not at all difficult to have growing in the school room all the algae needed for the ordinary high school course. The growth may be increased by adding, once in a few months a little of Sachs' nutritive solution. This can be obtained in a convenient tablet form known as "Plant Food" from Edward F. Bigelow, Arcadia, Sound Beach, Conn. The best method of using these seems to be to crush a number, say a dozen, and dissolve them in about a quart of water. Add a few spoonfuls of this strong solution to each jar. In the case of yellow-green algae and *Chara* there seems also to be a decided advantage in having a few of the little water snails in each jar. They are scavengers and tend to keep the water in good condition. By this simple means within the reach of every teacher it is possible to have a constant supply of such common algae as *Chroococus, Oscillatoria, Nostoc, Phormidium, Spirogyra, Cladophora, Ulothrix, Oedogonium, Chara, Desmids and Diatoms.—Elda R. Walker.*

EDITORIAL

One year ago, complying with an order from a somewhat peevish Post Office department, we were obliged to stop all subscriptions practically as soon as they expired. This order allows weekly publications to send fifty-two issues after subscriptions expire, but denies the right of quarterlies to send more than one. We believe this is not only a harmful ruling but an unfair one as well, but we have no recourse if we wish to enjoy the same privileges in the mails that are accorded the weekly magazines. Our subscribers should understand, therefore, that the stopping of subscriptions is not dictated by a fear that we would not be paid if we allowed them to run. We fully realize that neglect to renew at once may be due to many causes besides a lack of funds, and we are perfectly willing to continue sending the magazine to *all who give us instructions to do so,* allowing them to pay during the year when most convenient. We have a constantly growing list of this kind, in which each person has ordered us to continue sending until ordered to stop. If you do not have time to renew at once, at least send us a postal telling us to continue sending.

* * *

Some wit, with a clear perception of actual conditions but with little veneration for the wiseacres in the service of the national government, has dubbed the science emanating from the Capital, "Washington science." The scientists at Washington, instead of considering this appellation a mark of approval, as it certainly is a mark of distinction, have become more or less perturbed over the matter. Various attempts have been made to explain the vagaries observable in publications of our government experts, and the general opinion seems to be that red tape is responsible. It may be doubted, however, whether this explanation explains. The reason that Washington science is different from the science of the rest of the world probably lies deeper, but we shall not attempt to bring it to the surface. We cannot, however, forego suggesting that Washington science can be made less Washingtonian by removing some of the more conspicuous ear-marks. How a free and independent citizen can endure to have his every contribution to science labelled "Published by the permission of" some clerk or department superintendent, is beyond our power to fathron. Doubtless it is necessary that men in the public service publish nothing detrimental to that service, but even if given permission to publish, why parade the fact?

BOOKS AND WRITERS.

Charles N. Skinner, author of several volumes devoted to the myths of various lands,has now issued one devoted to plants under the title "Myths and Legends of Flowers, Trees, Fruits and Plants." As is well known, there is a vast amount of folklore relating to plants in every land. The time is not yet very far back in the past when people believed in the Doctrine of Signatures and in the magic to be worked with certain species. The very names of the plants themselves indicate how very sincere was the belief in their supernatural powers at the time they were named. There is scarcely a saint in the calendar whose name has not some plant associated with it, while fairies, elves, and even the devil come in for a share. In the present book the author has brought together a large number of the legends and myths connected with these flowers. These will no doubt be entertaining to the general reader since they are well written and skillfully handled, but it is likely that the botanist may take exception to these statements, here and there. Some of the myths are rather too mythical or too evidently made to fit the facts, to be acceptable to the matter-of-fact scientist. The author, however, apparently makes no claim to being a botanist—his failure to use capitals in the generic names of plants indicate the fact—but he has made a readable book which is doubtless what he intended. The legends relate to plants from all parts of the world and are grouped under the best-known common name of each species these latter being arranged alphabetically. The book contains 300 pages and costs $1.50. It is published by the J. B. Lippincott Co., Philadelphia.

Prof. A. B. Klugh of Queen's University, Kingston, Ontario, has written a little book on "Botanical Microtechnique" which should prove useful to all microscopists interested in making permanent mounts. It gives directions for collecting, staining, sectioning and mounting by all recognized methods and by giving a single method for each avoids the confusion that often occurs when the student is obliged to pick out the best method from a number offered. The book may be had of the author for 50c.

Nature Studies in Temperate America" by Joseph Lane Hancock recently issued by A. C. McClurg & Co., Chicago, strongly reminds one of the works of an earlier writer, William Hamilton Gibson. The main interest in Gibson's work was centered in the excellent illustrations though the text was also attractively written. In the present book there is also a wealth of excellent lliustrations—more than two hundred drawings and photographs—and an equally interesting text but here the resemblance ends, for we are now introduced to more scientific matters, or at least to a more scientific treatment. There are eight sections in the book treating of such subjects as evolution, minicry, protective resemblance, adaptations in animals and plants, warning colors and the like and each section is filled with entertaining facts to illustrate the subject in hand. The great majority of these illustrations are taken from the insect world, the phase of nature with which the author seems to be most familiar, but they are presented in a way that is likely to interest anyone who has a liking for outdoor studies. The whole book treats of the animals and plants in the vicinity of Chicago, where the meeting of prairie, forest and lake shore gives a most varied set of habitats. It is an octavo of more than four hundred pages and costs $2.75 *net.*

A new book by Charles Francis Saunders, entitled "A Window in Arcady" chronicles the interesting features of the passing seasons as they have impressed the author while afield in the country about Philadelphia. Saunders is always a charming writer and not only has the faculty of seeing the interesting things in nature, but of seeing them in a new and attractive light. The book contains twelve chapters, one for each month in the year, and is illustrated with a number of excellent photographs by Henry Troth. It is published by Edward T. Biddle, Philadelphia at $1.25 net.

If the reviewer expected to spend a season on the Pacific Coast, the first thing he would ask for, upon landing would be a copy of Parsons' "Wildflowers of California." Evidently a good many others are of the same opinion, for a revised edition of the book is now in its tenth thousand. The big fire that followed the San Francisco earthquake destroyed the original plates of the book, as well as the stock of printed volumns, but a new edition was issued in 1906 and, so far as we know, is the best popular manual to be had by the tourist interested in California botany. It contains descriptions of all the common wildflowers of the region and is illustrated by about 200 excellent drawings by Margaret Warren Buck. The book is published by Cunningham, Curtis, Welch & Co., at $2.00 *net.*

Helen Rutherfurd Ely, author of "A Woman's Hardy Garden" has recently issued "The Practical Flower Garden" from the press of the Macmillan Co. Books devoted to the practical affairs of gardening fall into two classes: they may give explicit directions for all sorts of planting and cultivating or they may discuss in a general way all the operations of the gardener. The present book falls into the latter class. In the preface the author tells us that it gives her garden experiences of the past five years. We are therefore prepared for a discussion of such subjects as Color Arrangements of Flowers, Raising Flowers from Seed and Terraces and their Treatment. The book is well written and will interest all who are endeavoring to make a garden that is something more than a place to grow plants. There are eight colored plates and nearly a hundred other illustrations. The book is published at $2.00 net.

A short time ago, we had occasion to call attention to two books by Winthrop Packard and now chronicle another with the title of "Wood Wanderings." Like the others this is devoted to various phases of nature treated in a rather poetic and sentimental vein but good reading withal, especially at this time of the year when the season and book coincide, as such titles as When Autumn Passes and November Woods indicate. The book is published by Small Maynard & Co., at $1.20 *net*.

"The Story of the Soil" as the title of a book might mean a variety of things depending somewhat upon the author. In the hands of Dr. C. G. Hopkins, Illinois' energetic and efficient soil expert, it becomes a novel in which the hero applies the knowledge learned in school to the practical work of improving a worn-out farm and incidentally gains a wife and "they all live happily ever after." Dr. Hopkins has been writing on soil fertility for many years and has adopted the story form of getting his facts before a lot of people that could not be reached otherwise. It is a sort of sugar-coated treatise on improving the soil and as such is likely to do much good in its way. The book is from the Gorham Press, Boston and sells for $1.50.

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DEVOTED TO ECONOMIC
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BLACK HILLS PINE
Porcupine Butte, South Dakota

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I wonder if the sap is stirring yet,
If wintry birds are dreaming of a mate,
If frozen snowdrops feel as yet the sun,
And crocus fires are kindling one by one?
Sing, Robin, sing!
I am still sore in doubt concerning spring.

—Christina Rossetti.

SOME DAKOTA WILD FLOWERS.

BY H. TULLSEN.

THAT Elysian region, the country of the Great Plains, is, when summer reigns, one of the most attractive flower-kirtled regions in this world. In the Pine Ridge territory of South Dakota, within sight of the Black Hills, which, in clear weather, appear just above the far northwestern horizon, an immense tract of land has been set apart as an Indian reservation, and, in consequence, much of the district still continues in all its virgin grandeur. The beds of the streams, nearly all of which discharge their waters into the "Maki Zita," or Big White River, lie very far below the general surface of the surrounding country and their flood-plains are, in the abrupt valleys, mostly covered with decidous trees and shrubs. A few water-courses next the sand-hills on the south, however, meander through broader, level tracts that partake of the nature of swamps and wet meadows.

Here in the alluvial soil there is of course a vegetation such as is characteristic of well-watered flats in general. Clinging to the banks at a moderate elevation we find such shrubs as the skunk-bush and buffalo-berry, while in the way of herbs we are apt to meet with the bastard toad-flax, wild sweet pea (*Lathyrus*), or, very rarely, the golden corydalis. Then, as we ascend a little higher, there come the prickly pears, Missouri cactus, and yucca, with all that hardy legion whose members can withstand the droughts and freezing winds. Upon the highest hills where limestone rocks lie exposed or near the surface we find the Black Hills pine (*Pinus ponderosa scopulorum*), clustered in groves or growing isolated. Whenever I look upon these hardy conifers facing the boreal blasts on the most elevated ridges, I always recall a line in Pope's Homer:—

"Where cold Dodona lifts her holy trees,"

notwithstanding that the trees which shadowed the sacred oracle of Zeus were oaks, not pines.

Whoever observes vegetal forms in a region where the physical features of the surface are greatly varied throughout restricted areas can plainly see the results of the laws of organic evolution, and he sees them *as such*. Near the water-courses, fortuitously introduced by man, we meet the common ribwort (*Plantago major*) thriving in just such a habitat as is to its liking. It is perfectly adapted to its environment; therefore it will not change in form or habits. Now ascend the near-by hill a hundred feet or two, and though no rain may have fallen at any time through all the month of June, yet you will find there another kind of plantain—Pursh's plantain (*Plantago Purshii*) it is called. It, like the common species, is adapted to surrounding conditions, and hence it, too, need not, and will not change. But this environment is the dry hillside, so different from the moist, alluvial flat that constitutes the habitat of the ordinary plantain. Both, however, are plantains, and therefore are descended, together with many other species, from a common ancestor. This old-time plantain, like our common ribwort, likely dwelt in moist soil, for there can be no reason for supposing that it began life as a xerophyte, under conditions of aridity. Our door-yard plantain, or ribwort, is a smoothish plant with broad leaves. Pursh's plantain, on the other hand, has narrow leaves densely covered with hairs, as are the spikes of flowers also, and it follows that the evaporation is thereby reduced to a minimum, thus enabling the plant to dwell in dry regions. We must conclude that Pursh's plantain acquired its narrower leaves, covered with hairs, and its villous spikes, little by little, through a long period of years or centuries. For, as the old valley or plain on which the ancestral plantain dwelt became drier and yet drier, year by year, such individual plants as were slightly woolly, or had narrower leaves than usual, were best able to withstand the droughty conditions, and in consequence they and their descendants survived, while all the smooth and wide-leaved plants that did not hug the immediate water-margin perished. As time went on the woolier and linear-leaved plantains continued to increase in numbers and spread to higher and drier levels, losing, at length, almost all outward resemblance to the older form of the lowlands. Hard by the stream, then, is the progenitor of Pursh's plantain, or at any rate, a plant closely resembling it, on the heights are the descendants, and the hills that intervene roughly represent the ages that have elapsed and the difficulties that have been overcome.

The members of the parsley tribe, for the most part, bear a strong family likeness to one another. But who would perceive, at first blush, that the *Cymopterus* of the plains was a member of this group? These plants—there are two species, both called "Cheyenne turnip" by the Sioux—appear in early spring, and their umbels lie close to the surface of the soil. Through the survival of the fittest the *Cymopterus* has come to adopt this habit of growth, thus avoiding the buffeting winds of earliest spring. Another well-marked group is the Compositæ, or sunflower family, the members of which are best known as strong, able-bodied plants, most abundant from mid-summer well into autumn. But early in the year there appears one of this family called the *Townsendia,* a humble dweller next to the soil where its rather sizeable heads are conspicuous, though it has no stem to speak of. Its success in life is owing to its geetting out betimes, before the rush and conflict that ensue when the hosts of the summer plants arrive.

The early spring plants of the arid or semi-arid regions have, many of them, acquired this beneficial habit of clinging close to the surface of the soil, thus obtaining partial shelter from the searching winds. The smoothish yellow violet (*Viola scabriuscula*) is one such, and the *Phlox Douglasii,* which, on elevated ridges, smiles up at the traveler from the grassy dimples of the ground, is another.

Early in April, or sooner, is seen growing among the hills the pasque-flower (*Pulsatilla hirsutissima*). It prefers moist ravines, and is abundant in the shadow of the pines. A little while after this plant has first come into bloom, the leaves of various perennial species, anxious to greet the spring, show themselves above the surface of the ground. We now recognize the first foliage of vervains, nettles, pentstemons, artemisia, *Leucocrinum,* squaw-weeds, and divers others, that in a short time will appear in all their glory.

Next in spring blooms *Leucocrinum montanum*—the "little white lily" or "May flower"—bestudding the prairies with its countless stars. By May 25 it has disappeared almost entirely from the open plains, but along fences in sheltered, cool nooks, it still tarries, now and then, as vanquished races sometimes linger for ages in localities where their conquerors come not. About May 20, *Zygadenus venenosus,* a "camas," takes the place of *Leucocrinum* as the most conspicuous vegetable of the plains. A few years ago an Indian child of the reservation was fatally poisoned from eating of the bulbs of this plant, and the red men, easily awed in the presence of anything whose action or properties they cannot understand, are said to call the *Zygadenus* "peji wakan," or "mystery-grass."

When May is well advanced there is an abundance of vegetal forms to employ and delight the botanist. *Pentstemon grandiflorus* is a sort of hot-house flower, a pet of nature, as it dwells in patches on the alluvial level near the water-courses, sheltered by banks and copses. It is very beautiful in foliage and flower, but I am rather more attracted by another species, *Pentstemon acuminatus,* I believe, which braves the drought of the limestone hills and the sand-dunes, and fears not the onslaught of the moistureless winds that are sure to beset it in such exposed situations. *Pentstemon cristatus,* too, dwells on the higher ground, but sticks to the elevated flats rather than to the hillsides. Its flowers here are nearly white, instead of red or purple as the text-books say they are. *Pentstemon gracilis,* a fragile-looking beauty, has chosen yet another kind of haunt, as it finds the low depressions in the prairies, where rain-water sometimes stands, to its liking. That handsome herb, the bellflower, which is the same as the "bluebells of Scotland," abounds in similar swales amid the hills.

Steironema cilatum haunts the shaded dells; surely it must be favored of the wood-deities—of those gay and careless nymphs that sport with sunbeams, bees, and blossoms: for so successfully does it shield itself from the inquiring gaze of men that, common enough though it is throughout our country, and more attractive in appearance than many flowers that are known the wide world over, yet it has received no vernacular name by which we may call it. He that knows the herb at all alludes to it by its scientific appellation, or perhaps by that bookish one of "fringed loosestrife."

About the first of June spiderworts make their appearance; they flourish not only in wet meadows where we would think of looking first for them, but to a considerable height upon the hills also. About this time red false-mallow (*Malvastrum cocineum*) has become plentiful along all roadsides and trails. It is one of those herbs that are utilized by the Sioux medicine-man in his practice. Indeed, the mucilage that the plant contains is said to be an efficacious hemostatic remedy. The root, which is the part used, is mashed and applied to fresh cuts, whereupon the flow of blood is soon checked. Contemporary with the false-mallow there occurs a plant that is far from being a like favorite. I refer to the stemless loco-weed (*Oxytropis Lambertii*). which, however. has wrought but little mischief in this vicinity. It is more common in the sandhills than elsewhere.

In late May and in June the Mariposa lily, one of the loveliest blooms in all the enflowered realm of nature, is abundant upon the sides of the more rugged hills. "Butterfly lily" is another very appropriate name that is sometimes applied to it, and its generic appellation, is *Calochortus,* signifying "beautiful herb." In the region of the limestone hills at this season, too, *Lithospermum linearifolium*, a homely puccon, is much in evidence, while among the sand-hills the hairy gromwell, a closely allied species with most beautiful orange-colored blossoms, greets the eye everywhere. Poets and theologians no doubt would tell us that that plainer puccoon was suffered to dwell in the more varied upland country and help in its small way to eke out the number of attractions already there, while the beautiful orange-blossomed species was preordained to grace the dreary wastes of the sand-hills, and cheer the weary traveler on his way. But being neither poet nor teleological theologian, and knowing as I do that variations in plants and animals occur according to the formulas of chance or error, I must consider the contingency of color in large measure, as a mere accident of evolution.

It is a fundamental fact of botanic lore that all the parts of a flower—pistils, stamens, petals, and sepals—are but modified leaves; and in the showy *Mentzelia* that grows near the Bad Lands, we are able, if we examine the blossoms, to find a hint of this truth. Our *Mentzelia* has ten handsome petals, and its excedingly numerous stamens, with their thread-like filaments are typical in form. But if we had here in hand a number of specimens of different kinds of *Mentzelia* from various parts of the country we should see at once how stamens grade into petals. Thus, the smooth-stemmed *Mentzelia* has five full-sized petals only, with sometimes five additional narrower ones. Other species, as for example, the one I recently saw in the Wasatch mountains, have the filaments of a number of their stamens flattened, and those broadened organs become more and more petaloid as they approach the circumference of their field, where the true petals are situated. As all the *Mentzelias* have stamens enough and to spare, it can be easily understood how some of these organs may have been converted into petals. First some of them became flattened, though still bearing anthers, as was observed in our Utah *Mentzelia*; next the anthers were lost, leaving, say, five narrower inner petals within the ring of outer broad ones; and at the final wind-up all the petals were large and broad, as in the case of our Dakota *Mentzelia*. Of course there was a reason for all this modification, the need being the productions of a showy corolla to attract insects and induce them to aid in the cross-pollination of the flowers.

(*To be Continued.*)

EVERGREENS IN WINTER.

By Frank Dobbin.

WHEN the white mantle of winter is spread over the world, it is a relief to the eye to look away to some distant hill and see a clump of our common red spruce (*Picea rubra*) trooping toward the summit like a file of soldiers, their dark green uniform in striking contrast to the world of whiteness all about. But if we plod through the snow toward some upland swamp we notice upon entering its borders that the spruce of the hillside has become noticeably smaller and a closer inspection will show us that the red spruce has given place to a smaller species, the black or swamp spruce (*Picea mariana*). If our section be more northern the white spruce (*Picea canadensis*) would be sure to claim our attention.

Standing on the wind-swept crest of some crag and looking from the wintry woods all about to the billowy green at our feet we are sure to be looking down upon the tops of a fine growth of our common white pine (*Pinus strobus*),—tree of utility and beauty. If some few stand up with more stiff erectness and less of grace than their neighbors, it is likely that you see the pitch pine (*Pinus rigida*) or if in the right locality the red pine (*Pinus resinosa*). Little hint is there now among these still sentinels of the wintry forest of the soft threnody that the summer winds will play among their branches. But look away to that bare hillside pasture. What are those patches of green scattered here and there upon the snow? naught but the dwarf juniper (*Juniperous communis*). A tree that usually contents itself with sprawling its branches over as large an area as possible, though it does sometimes reach a height of fifteen feet. In habit it somewhat resembles those plants of the arctic regions that must perforce closely hug mother earth if they would exist at all. A near relative, the red cedar (*Juniperous virginiana*) may pierce the sky line with its spire-pointed top,—a handsome and dignified tree. If our line of vision chances to cross some swampy area we may see that beautiful evergreen the white cedar or arbor vitae (*Thuja occidentalis*): its closely woven and matlike branches furnishing a refuge for some of our feathered friends these wintry days.

Because a plant or tree is common we are apt to overlook its beauty. Such perhaps is the case with the hemlock (*Tsuga canadensis*) which is a common feature of the winter landscape in localities not entirely denuded of the forest covering. The apex of this tree is generally bent to one side and is said by old woodsmen to indicate the direction of the prevailing winds.

However we must not forget what is probably the most beautiful evergreen in our northern forests, the balsam fir (*Abies balsamea*) with its indescribable tint of bluish green.

A lover of the high places on mountain slopes or becoming shrub-like toward the tops of the higher mountains. Prick one of the numerous blisters on the trunk of a younger tree and the clean balsam gushes out with a fine resinous odor.

But if our homeward way lead us through the snow that covers the ground in the bare deciduous forest, we may come upon a spot where that humble little evergreen that does not pretend to the rank of a tree creeps over the floor of the forest. It is the running hemlock or American yew (*Taxes canadensis*); its seed inclosed in a red wax-like pulp that forms a fine contrast to the dark green of the leaves.

We return from our walk in the early twilight of a winter's day with numb fingers stinging cheeks, but what matters that if like the Concord philosopher we can—

"go to the God of the wood,
To bring his word to men."

Shushan, New York.

SOME LEAFLESS PLANTS.

By Dr. W. W. Bailey.

I AM repeatedly asked to give some account of the queer plants, devoid of foliage, that one meets in the woods or elsewhere. I do not now refer to fungi, which never have leaves or any thing representing them, but to such plants of high affiliation, as, in the course of time, have ceased to develop these organs.

In these cases leaves are not formed for the very excellent reason that they are unnecessary. Such plants make others do their work, and when they possess foliar organs, these are rudimentary and rarely, if ever functional. We have quite a number of plants that are in this situation. The best known of them, perhaps, are the Indian-pipes, two species of *Monotropa* of the Heath family. It is curious to find a plant of high ordinal type, by descent an aristocrat, adopting the degrading habit of parasitism. It is parasitic, too, on decaying matter, a *Saprophyte.* Its very tastes have been deteriorated. Still this plant is, in its way, very beautiful. Walking through some dense, dark wood, the saunterer alights upon a group of these snow-white plants. The foliage is represented by abortive scales, their arrangement showing that they are really leaves. The pretty flower nods on its stem until such time as it goes to seed, when it becomes erect. At first white, it eventually assumes a black color, when it is known as the "corpse-plant." The common species has but one flower on a stem, but another, not so common, yellowish or orange in color, produces a cluster. They are severally known as *Monotropa uniflora* and *M. hypopitys.*

Quite like these "pipes" though belonging to a different family, are the beech-drops that spring up from the roots of beech trees. They belong to the broom-rape family in which in May we find the cancer-root, *Aphyllon uniflorum*, and less commonly the very singular *Conopholis* or "squaw-root." Much as I have tramped the woods in the last forty years, I have never until this season seen the latter. It was brought to me from my own stamping ground, as it were, by an observant young graduate of Radcliff. It grows in oak woods among fallen leaves and is "as thick as a man's thumb," covered with fleshy scales which later become hardened. In all these broom-rapes there is a gamopetalous, two lipped, ringent corolla, persistent and withering. They are not without a certain odd attractiveness, especially *Aphyllon* which is purple or yellow in hue. It has a wide range from Newfoundland to Texas and the Pacific.

Certain orchids, as the coral-roots, have this same fungoid appearance and habit, and fail to develop leaves. Some of them are exceedingly pretty. There are quite a number of species. Then, there are the dodders, *Cuscuta*, of the morning-glory family; true parasites, that do not possess even the rudiments of foliage. Even their embryos fore-shadow the later growth; they are mere twining caulicles, without cotyledons, even.

Beginning its life in the ground, the dodder gropes about till it reaches a desirable host or nourishing plant. In this respect it exhibits natural preferences and many become very destructive, as with flax in certain parts of Europe. In the United States I am not aware of its having done any great damage though it is easy to see how it might when one observes its Lacoön coils seeming to throttle some neighbor. Upon plants that we have most seen them, in New England, to which our observation are mostly confined, mid-summer dodders resemble entanglements of brass or copper wire, and often appear to smother neighboring herbage and shrubbery.

It is interesting throughout nature to note how often organs are retained as mere reminiscent traces. as it were. of parts which have long since ceased to function. They often throw light on the origin and development of certain parts of a plant. They are records perhaps of an earlier time, laid away for the savant to read.

Providence, R. I.

THE BOTANIST AND THE PUBLIC.

IN no phase of science has there been a greater change of position in the past few years than in botany. As formerly taught in our schools and colleges, the science was chiefly a course in the analysis of flowers with the end in view of enabling the student to name the flowering plants he might happen to find. Such studies gave impetus to the plant collector and exalted the local flora and thus rather deserved the quip that "botany is a study suited to the leisure hours of old maids and elderly men."

But the science can no longer be classed among the strictly ornamental studies nor its devotees be regarded as harmless cranks interested in gathering flowers and to be tolerated rather than encouraged. The botanist is now a man of affairs upon whose knowledge the whole world depends for the successful development of many important enterprises.

Our waning timber supply is rapidly bringing the subject of forestry into the foreground and has started an ever increasing demand for young men who can grow crops of trees in the most economical manner. This work calls for a wider knowledge of botanical matters than the student of an older day could bring to bear upon it. The requirement is not that the forester know the names of his specimens—though that is essential—but that he be familiar with the needs of his plants as well and skillful in supplying the things which they lack. He must be able to recognize at sight the insect and fungous pests that harm them, quick to apply the most effectual remedies against their inroads and he must also know the value of the different species under his care and the uses to which they may be put.

Within a generation, agriculture has ceased to depend upon the old hit-or-miss, rule-of-thumb methods of growing plants and has advanced to the position of a science with a corresponding reliance upon the botanist. Plant breeding is no longer left to a few experimenters but has become part and parcel of the up-to-date cultivator's employment. The plant breeder now takes an order for a certain type of pod and style of seed in beans, or for a certain amount of oil or starch in corn with as much nonchalance as the grocer's boy would take an order for a bushel of potatoes. With the aid of the botanist the farmer is learning how to double his returns from the land without the addition of a single extra acre and not only makes two blades of corn grow where but one grew before, but proposes soon to have at least half a dozen in the place of the one.

The success of the botanist upon land has been followed by a like success in the waters where, turning his attention to the sea flora, he has found millions of dollars worth of seaweeds, some edible and other useful in the arts, awaiting his harvest. The Japanese, possibly obliged by necessity, have been before the occidental in this phase of the science, but our own botanists may be depended upon to give a good account of themselves in this field when once they enter it.

In the realms of horticulture and landscape gardening the new botanist may be found giving a more artistic touch to the planting of public and private grounds, turning houses into homes and ever laboring for a more beautiful country side. He is active in promoting more extensive public parks and playgrounds, in the developement of cottage gardens, in the beautifying of lawns and the better decoration of cemeteries.

The public school system has also awakened to the needs of the times and is bending its energies toward making its courses in botany both useful and practical and more in harmony with present conditions. Everywhere a deeper interest is being taken in agriculture, agronomy, school gardens, nature study, field work in botany and the like. All this is an earnest of the place the botanist is destined to hold in the future development of our race and country, a place second to none in dignity and influence.

STRUGGLE BETWEEN FOREST AND PRAIRIE.

IT was a matter of great interest to the first explorers and settlers in Illinois that so much of the surface was occupied by prairie and that the forests were confined to certain physiographical divisions, especially the stream valleys. In seeking to account for this natural feature, the earlier generation of scientists, and to some extent even the modern ones as well, were influenced or even prejudiced by two wrong ideas. In the first place, as they and their ancestors had lived for generations in a forested country the forest came to be regarded as the only possible natural covering, and any other type of vegetation was considered extraordinary. In the second place, they did not at first recognize that the forests were everywhere slowly encroaching upon the prairies, or that the encroachment became measurable as soon as the prairie fires were checked. The prairie is not an extraordinary thing to be explained only by some strange or fanciful causes; it owes its origin to ages of humid climate in the east and southeast. These great climatic types, acting upon the plant world through evolution and elimination, gradually developed the two extreme types of vegetation, each of which was especially adapted to its own environment. After the close of the glacial period, migration of each of these types brought them in contact in Illinois and neighboring states and a struggle for supremacy began between them. The outcome is decided mainly by two sets of factors; first the control of the environment by the vegetation and second the climatic conditions of temperature and rainfall. In the first case, the prairie vegetation, by virtue of its close sod, tends to prevent the proper germination and growth of the forest tree seedlings. Prairie fires, following the advent of man also tend to restrict the growth of the forest. On the other hand the forest has control of the light supply for the herbaceous layers and the well established trees are resistant to fire. Above all, the climatic conditions are favorable to forest. The balance has been in general in favor of the forest and it has advanced slowly upon the prairie. The greatest speed of advance has been along the lines of least resistence, the water courses, and has resulted in long strips of forest paralleling the streams and usually widest on the east side of streams or marshes where they were better protected from fire. In the sand regions the forest distribution is not regulated in that way because of the absence of small streams, but it does show a possible relation to fires. Where the sand lies in disconnected ridges separated by strips of moist or swampy ground acting as fire-breaks there is a good growth of forest on the higher ground.—*Dr. H. A. Gleason in Bulletin of the Illinois State Laboratory of Natural History.*

NOTE AND COMMENT

Wanted.—Short notes of interest to the general botanist are always in demand for this department. Our readers are invited to make this the place of publication for their shorter botanical items. The magazine is issued as soon as possible after the 15th of February, May, August and November.

Longevity of Botanists.—An interesting illustration in support of the opinion that working among plants conduces to health and long life is found in the lives of two botanists who died within two days of each other in December last. One of these, Victor Lemoine, a descendant of a long line of gardeners and himself a horticulturist of world-wide fame was in his 89th year. The other, Sir Joseph Dalton Hooker, was still older lacking only about six years of reaching the century mark. Hooker, it scarcely need be said was the son of Sir William Hooker, also famous as a botanist, and the director of the Kew Gardens, to which position his son succeeded him. The long life enjoyed by these botanists was not the result of existence in which work played no part. On the contrary, they were both unceasing in promoting the interest of their favorite sciences almost up to the time of their death.

Flowers Out of Season.—It is a noticeable fact that the flowers that linger with us the longest are not always the autumn flowers, but more often summer flowers that continue to bloom even after severe freezing weather. The dandelion for instance has been seen in bloom here as late as the first days of December. The tall bellflower (*Campanula Americana*) of our woods is sometimes found in bloom in November, after we thought all flowers of the woods were gone. Several of the violets make their appearance again in the fall, to give us a farewell visit, as it seems, before winter comes. The *Viola papilionacea* blooms profusely in shady places in late September and with the prairie violet (*V. pedatifida*) have been observed as late as the last days of October. This season the writer saw, for the first time, the yellow violet (*V. pubescens*) in bloom in the fall. One solitary flower made its appearance about October 24th and was observed for several days. The heavy frosts of the time did not seem to hurt it. Some years ago the writer observed an interesting case of a plant blooming out of season, when he found a pasque flower in bloom on the fourth of July. The flowers was undersized and the sepals pale almost white.—*B. O. Wolden, Wallingford, Iowa.*

THE GOGO VINE.—Visitors to almost any tropical seacoast are likely to find cast up with the shells and other flotsam and jetsam certain large flattened chestnut colored beans two inches or more in diameter. These are sometime known as sea beans because ocean currents frequently bear them long distances and cast them up on shores foreign to the plants that bear them. The beans are the seeds of an immense tropical climber and are borne in huge pods that are often four feet long. The plant, which is known to science as *Entada scandens*, and in common parlance as gogo vine, contains saponin or vegetable soap and the bark and seeds are said to be much used by tropical people as a hair wash. The bark is thoroughly beaten and imparts a reddish tinge to the water. Taken internally the juice of the bark is reported to be of value in asthma. The hard polished seed-coat also has its uses and in other days was often made into snuff-boxes.

DEFINITIONS IN GENETICS.—There is one branch of botanical science that is moving so rapidly that for a time it bids fair to leave many otherwise excellent students far in the rear. This branch is plant breeding and its very newness makes new terms necessary. In *Science* recently, Geo. H. Shull has defined four of these terms that seem likely to find a permanent place in the literature of the subject. *Genotype* is defined as "the fundamental hereditary constitution or combination of genes of an organism" The gene, it will be noticed, is one of the characters that go to make up the individual. A *Biotype* is a group of individuals possessing the same genotype. *Pure line* denotes a group of individuals traceable solely through self-fertilized lines to a single homozygous ancestor, while *clone* is a group of individuals much like a pure line group except that they are derived from a single genotype by asexual methods—budding, slips, tubers and the like.

GOVERNMENT EUPHUISM.—Let nobody suppose that those dispensers of "Washington Science," are bound by the hard and fast laws that govern scientific procedure in general. When they have the inclination to let their fancies freely range they can turn as pretty a phrase as could any lexicographer after burning many gallons of the justly celebrated midnight oil. Some time ago, desiring to separate one of their number from the common herd of physiologists, the wights in the gevernment service evolved the highly ornamental title of Bionomist for him. Recently emboldened by this success they have put over another much better one which shows how very rapidly one improves with practice. This time the title is that of Xylotomist. It is evident that xylotomists are not common in captivity for the fact that the Forest Service needs a few at $1000 each has been mentioned in the newspapers. So far as we can ascertain xylotomist is Greek for wood cutter—or used to be when we were studying for the ministry. Now that severing old ties with a dull axe has risen to the dignity of a learned profession with an ornamental cognomen, it is barely possible that the wandering gentlemen of leisure may view the woodpile with a more kindly eye. What does the Government want of Xylotomists? To cut the dead wood out of the official force, of course! Any old laborer can cut real wood.

Beauty in Scientific Names.—"A rose by any other name" might have appeared all right to Shakespeare, but most of us confess to a mild liking for euphonious names whether common or scientific. It is therefore a distinct shock to discover that A. A. Heller recently perpetrated *Lupinus Pipersmithii* as the name of a Californian legume. Perhaps, however, the name will harmonize very well with horned toads, Gila monsters and other strange creations in that sunbaked part of the earth.

The Tropical Rain Forest.—Those who have botanized in the temperate zone, only, may be quite familiar with the tropical rain forest as it appears in literature, but they are not likely to have a very vivid conception of it as it really exists. In our part of the world it is almost impossible to imagine the effect upon the forest where it rains daily, often in torrents, and where moisture and light are at the maximum. In such places the constant moisture makes it possible for plants to grow upon the branches of trees, the roofs of houses, stone walls and similar situations. The trunks and larger branches of trees in the rain forest are often so loaded down with epiphytes—principally ferns, orchids, wild pines, lycopods, mosses and lichens—that they can scarcely be seen. The rainfall that makes all this possible is also hard to realize. A recent rainstorm recorded in the Philippines resulted in a precipitation of more than 88 inches in four days. That is, enough water fell in four days to cover every square foot of surface in that region more than seven feet deep. Nearly three feet of water (34 ins.) fell in one day. This however, is by no means the limit. In the Khasi hills at the head of the Bay of Bengal a rainfall of nearly ten feet (114.4 in.) occurred in five consecutive days in June, 1876. The record precipitation belongs to a small region in eastern Jamaica near Silver Hill, where in November, 1909, eleven feet and a quarter of rain fell in eight days. The writer of this note has a very vivid mental picture of the spot mentioned having botanized there some years ago. The most crowded conservatory in our cooler latitude but faintly represents the crowd of species there. Tree ferns vied with flowering plants for room to spread their leaves, the ground was one extensive carpet of selaginellas, mosses and ferns, and with every passing shower, water dripped from a thouasnd filmy ferns and mosses on the trees to fall upon and renew the verdure below.

Legumes in a New Role.—Everybody, nowadays, knows that legumes add nitrogen to the soil they grow in for the reason that they have certain bacteria living on their roots that take nitrogen from the air and fix it in the soil in a form that plants can use, but it is not well known that legumes, in some way actually facilitate the absorption of nitrogen by other plants when grown with them. Timothy grass grown with such other legume forage crops as alfalfa, red clover and peas showed a gain in protein content of from fifty to one hundred and sixty pounds per ton, the protein, of course, requiring nitrogen in its composition. This gives an additional reason for the custom, common among farmers, of growing clover and grasses together. For more than a hundred years the fact that a legume might aid a non-legume to obtain a store of nitrogen when grown with it, has been hinted at, but it is only recently that careful experiments have placed the supposition upon a solid basis of proof.

Parthenocarpic Fruits.—A great many more flowers are produced than ever give rise to fruits. In some species if a fruit should result from every flower that opens, the plant would be unable to form sufficient food to bring them to maturity to say nothing of the weight that would have to be supported. We find, therefore, that almost as soon as the flowers close, the plant begins to cut many of them off. In the case of the apple fifty or more young fruits are cut off for each one that remains on the tree. It is commonly believed that the plant cuts off only those flowers that failed to be pollinated, but this is a mistake. Many flowers in which the ovules were fertilized appear to be thrown down before the fruits have had a chance to develop. At the same time the fact must be overlooked that there are many flowers in which pollination does not take place that nevertheless give rise to perfect fruits though seedless. Among familiar examples may be named the small grape from which the dried currants of the shops are obtained, the banana, the naval orange, the sultana grape, and various apples and pears. Such fruits are called parthenocarpic fruits and serve well to illustrate the fact that there no hard and fast lines in nature. There are certain lines along which each plant part develops, but when occasion presents itself the lines may be abandoned.

Use of the Caruncle.—A considerable number of species scattered throughout the plant world have seeds in which the seed coat or testa grows out at the point where the seed is attached to the ovary forming a fleshy object called the caruncle. Those who hold the opinion that no plant structure has been evolved unless called into existence by some need for it, have been puzzled to account for the caruncle. For a long time it has been suggested that ants and other small insects might find the caruncle palatable and thus carry the seed away for the sake of it, and effecting a wider distribution of the plant. The loss of the caruncle appears in no way to hinder the germination of the seed. Additional evidence in support of the theory that this object is useful in seed dissemination has recently been found in the case of the European gorse (*Ulex europaeus*) which is found abundantly along roadsides, and about cottages where ants are also found. In such places it even invades plant groups where it does not grow naturally. This is found to be due to the fact that that the seeds are spread by ants which carry them away for the sake of the bright orange oily caruncle. The broom (*Cytissus scoparius* is also said to be distributed in this way. Plants whose seeds are thus distributed are called myrmecochorous plants.

Propagation by Roots.—Ordinary roots originate from stems and not stems from roots as is popularly believed. The source of this mistake is doubtless to be found in those plants which die down to the earth, each autumn, and in spring grow again "from the roots" as common parlance has it, though the botanist knows that the new shoots really spring from underground stems and not from true roots. Although normally roots do not give rise to stems, yet species in which roots can do this are by no means rare, and in fact, so unvarying is this feature that man depends upon it for propagating several of his food plants. The sweet potato is, unlike the common white potato a true root and is propagated by shoots that arise from it in considerable numbers; in fact, this plant seldom, if ever, produces seed its usual means of multiplication being by means of such shoots. The yam a tropical root, not very closely allied to the sweet potato though often confused with it, is also multiplied in this way. Among vegetables of northern gardens propagated from sections of roots capable of originating buds and shoots may be mentioned horse-radish and sea kale. The dahlia is a familiar instance among plants cultivated for ornament and others are phloxes and butterfly-weed.

Decorative Salt Bushes.—Apropos of the note on this subject in the November issue, I would like to note another decorative *Atriplex* in addition to those mentioned namely. *A. hymenelytra,* a charming plant to my eye, growing in our southwestern deserts. The foliage is the conventional desert gray-green in color and the prickly edged leaves are so much like the holly in shape, that they are sometimes utilized for making up into wreathe and often ornamental forms at Christmas time, for sale in the California cities. From its native habitat it must be very tolerant of drought and probably of alkali, and would be an addition to any garden of ornamental shrubbery in a climate that would suit it.—*C. F. Saunders, Pasadena, Calif.*

SCHOOL BOTANY

Love of Nature.—Those who love nature can never be dull. They may have other temptations; but at least they will run no risk of being beguilded by ennui, idleness or want of occupation, "to buy the merry madness of an hour with the long penitence of after time." The love of nature, again, helps us greatly to keep ourselves free from the mean and petty cares which interfere so much with calm and peace of mind. It turns "every ordinary walk into a morning or evening sacrifice," and brightens life until it becomes almost like a fairy tale.—*John Lubbock.*

Unstable Nomenclature.—I have myself long pursued priority in the hope that names would be both stable and usable. I have even advocated the forcing of prior forgotten names back into general nomenclature. I did so as long as mere temporary convenience seemed at stake. I did so while names doubled in length, trebled in absurdity and quadrupled in number. I did so until family names began to fall and to be set up again in exchanged places. I did so until I became unable to read the literature in several groups of which I had once been a student, or to converse with modern students of these groups. I did so until it became well nigh impossible for me to give my classes intelligible references to the literature they most needed to consult in their work. And then I began to entertain doubts as to the approval of posterity, the best kind of foundations, etc. I began to lose faith in priority as a cure-all for nomenclatural ills. For the real burden of nomenclature will be but little altered by the strictest application of this law. With all the arduous labor now required of any youth for gaining even an elemental conception of the worlds accumulated store of knowledge, why should any man, even though a profound scholar familiar with the intricacies of his own field, so far forget or minimize the difficulties of the long way by which he has come, as to be willing to leave the path harder for the next comer. Ought not the way that leads to a working knowledge of plants and animals to be as easy and plain as we can possibly make it? I think so.—*From an article by J. G. Needham, in Science.*

CARELESS USE OF WORDS.—The attention of those in charge of beginning botany laboratories is so constantly called to errors in the use of common terms that it is desirable that the notice of high school and grade teachers be called to it. A very common case with reference to the three dimensions will illustrate the point. A wood cell which measures about 10 micromillimeters in width and about 1000-2000 micromillimeters in length is repeatedly described as "very short" instead of "long and narrow" as is evidently correct. When corrected the student still affirms that it *is short*, "It is only 10 micromillimeters across this way." He uses "short" to apply to any thing measured by a small number of units, and "long" to that measured by a large number of units, rather than distinguishing the two axes of a given object as width and length. To be logical he would say that a rod is short because one of its dimensions is two rods, ignoring the fact that its other dimension is several hundred miles.—*Elda R. Walker.*

THE TYPICAL MONOCOT SEED.—It is the endeavor of the intelligent teacher, when the subject of seeds is up, to use such types as will give the student a comprehensive view of the variations that occur. Instead of devoting a certain number of periods to the study of seeds with no definite end in view except to fill up the time with work that is easily handled, the pupil should be given first a simple seed, that is, one that contains only a complete embryo, such as that of bean, and when this is understood, a seed containing an embryo and endosperm may be attempted. Only after all the parts of this second seed have been made out should the pupil be given seeds that lack plumules or those in which the endosperm is peculiarly located. Last of all should come the monocot seed. The seed usually studied is that of the corn, but large as this is, the embryo forms so small a part of it, that a seed with a larger embryo is much to be desired. It is unfortunate that many large monocot seeds have such small embryos. If anybody knows of a monocot seed with parts more easily made out than those of the corn are, it would be a great aid, to teaching if he would make it known.

THE SELECTION OF A LENS.—In selecting a simple lens or magnifying glass, many people are puzzled when they come to compare prices and magnifying powers. An instrument may be bought for fifteen cents that will magnify as much as one that costs half as many dollars and the beginner naturally inquires where the difference comes in. In answer it may be said that there are two differences, one in the lens, the other in the setting. The cheapest lenses, and also the most serviceable considering the price, are certain French glasses mounted in a nickel case and costing fifteen and twenty-five cents. Equally handy are the socalled "thread testers" which may be purchased of jewelers and stationers for twenty-five to fifty cents. These fold up and may be carried in a small pocket or even a pocket-book. Still other glasses may be had mounted in rubber cases with one, two or three lenses. All these instruments, however, have one decided drawback; when the object to be viewed is brought into focus, it can be seen clearly only in the center of the "field." To make the object show distinctly additional lenses must be used and this is the first thing that increases the cost. One kind of magnifier designed to overcome this defect is the coddington, in which a thick cylindrical piece of glass lens-shaped on the ends nas a ring cut round the middle and painted black. This is mounted in a nickled case and costs $1.50 and upwards. The same effect as well as higher powers is secured in more expensive instruments. by the use of two lenses, one in each end of the frame or case and frequently these lenses may consist of two different pieces of glass cemented together. The price now depends in great measure on the mountings of the lenses. Those in which the lenses have no mountings of their own but are merely held in position by other parts of the case cost from fifty to eighty cents; other in which the lenses are set in frames that are removable for cleaning cast a dollar and upwards. The very expensive lenses running upward to ten dollars are expensive principally because of finer workmanship and clearer lenses.The magnifying power does not increase in proportion to the cost. At the other extreme, one may secure pretty good results with a drop of water and a bit of window glass, if the glass is held horizontally with the water drop on the under side. More permanent microscopes of fair usefulness may be made by mounting a bead of glass in a metal plate. It is this kind of an instrument that street fakirs are fond of selling the public at a good price. It is, however, the type of the first microscopes and it was an instrument exactly like this that Leeuenhoek and Grow saw the first plant cells ever known.

LEAF PRINTS.—In the primary grades pupils are frequently taught to make blue and other prints of various wild-flowers which are subsequently mounted in books. Often. however, the prints fail to show much detail and the best results are not attained. If the teacher would confine these prints to the leaves of trees there would rarely be a failure and in the end the pupil would have a book of practical value provided the names of the trees were given.

EDITORIAL

Whenever a new man succeeds to an important job he usually has an irresistible impulse to make a few changes; otherwise the smooth running of the machinery would fail to show that the business was in different hands. Some such idea as this circulates through our mental works every time we contemplate the recent decisions of the post office department. This time it is the hitherto unheard of scheme of sending magazines by freight. The service is called fast freight but this is an euphuism that is probably injected into the title in order to let us down easy. A government that voluntarily abandons the most rapid method of distributing its publications in order to send them by freight, should have a crab—or perhaps a lobster—in place of the eagle in its coat of arms. Many readers do not know that the delay in receiving their magazines is due to this cause, but the secret is rapidly coming out. If their magazines do not appear on time they should take the matter up with their postmaster. After all perhaps one ought not be too hard on the postal authorities. They may have formed their opinion of the value of printed matter from the stuff sent out from the government printing office.

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In one of our leading scientific publications, a controversy has recently been raging rgarding the discovery of a new principle in agriculture. The parties to the argument are scientists of some repute and one would naturally suppose they might be differing regarding the merits of the discovery or regarding its application in producing more or better crops, but this is far from being the case—they are simply quarreling over which one discovered it first. This shows up one of the greatest weaknesses of botanists in a peculiarly bad light. We have so long looked with favor upon the *first* man to do a thing, even altering our system of nomenclature in order to exalt the first namer of a plant, that it is only to be expected that a number of I-saw-it-first scientists should be developed. After looking through a few volumes of botanical papers, a hasty man might make the assumption that botanists are in the business chiefly for the glory they can squeeze out of it; after reading still further, it may be doubted whether he would find much reason to change his mind.

* * *

At last the long-delayed indices to volumes 5, 6, 7, 8 and 9 of this journal have been printed. Since these can be of only cursory interest to those who do not possess the volumes named, they will not be mailed to our entire subscription list. We shall send copies to all public libraries, and schools to which the magazine goes and to those subscribers known to possess complete sets. If any owners of sets chance to have been overlooked, we shall be glad to mail them the indices as soon as notified. Since the edition is limited—only enough having been printed to complete the volumes still unsold and to fill the estimated demand from subscribers—it would be well to get requests in early. A delay may mean disappointment.

BOOKS AND WRITERS.

One does not botanize long in any extensive region before perceiving that a striking difference exists between the plants of bog, swamp, sand dune, woodland and cliff. Adjacent regions, though exposed to identical conditions as regards heat, sunlight and rainfall, may nevertheless bear very different groups of plants and the inference is unavoidable that this difference is due principally to the soil. The grouping of the plants, however, is not of a hap-hazard character, but on the contrary is so definite that a good botanist can make a pretty accurate list of at least the genera in a given locality without even seeing it. To take a simple instance, who would not, if asked to list the plants of a small lake with muddy shores, name the water lily, cat-tail, arrow-leaf, pickerel weed, smart-weed, blue flag, willow, red osier, alder, and many others and guarantee that more than 75% of them would be found growing there. The ecologists who have been working on this problem for some time have now arrived at a point where they can pick out the associations of plants that inhabit a definite locality, and can also name the changes in the grouping that will be produced by more or less water, shade and the like. Plants of a dry upland will be of one type when the soil is sandy and of quite another when it consists of clay or calcareous loam, while the addition of more moisture to any of these habitats will make still other changes. This relationship of plants to their habitat is found throughout the world, though the species forming the associations must of necessity change with the locality. It is of interest to note, however, that while the species change, the genera are much less likely to do so. All this is apropos of a recent book by A. G. Tansley, entitled "Types of British Vegetation" in which the plant covering of the British Isles is discussed from this viewpoint. To American readers, its chief value, aside from the very clear outlining of the various associations will be the comparisons between our own flora and that of Britain, which it for the first time makes possible. A large number of the species are, of course, identical with our own, while many others are closely related. The book runs to more than 400 pages and is well illustrated by photographs of various plant groups. It is published by the Cambridge University Press for whom G. P. Putnam's Sons are agents in America. The price is $2.00 net.

The "General Science Outline" issued by Percy E. Rowell in 1910 and reviewed in these pages has since been reprinted by The MacMillan Company with many additions and now forms one of the best introductions to general sciences that we have seen. The author has succeeded admirably in selecting for discussion the subjects likely to be met with in the life of pupils in the first year of the high school. More than 200 topics come up for discussion and are to be illustrated by about 100 experiments—for performing which directions are given. A valued feature is the list of references that follow each topic, making a further study of the subject easy. Here and there in the book the student will come upon statements that inadequately express the facts in the case, but this only slightly detracts from the value of the book and leaves it of sufficient interest to recommend to even the general reader. It contains 300 pages and costs 75 cents *net*.

Messrs. Ginn & Co., will soon bring out a new volume by the editor of this magazine entitled "Agronomy for High Schools." It is intended especially for the schools of cities and towns, and will treat of such phases of agriculture and horticulture as are adapted to the needs of children in city and suburbs, in this differing considerably from other agricultural texts now on the market.

Miss Mary F. Barrett of the State Normal School, Upper Montclair, N. J., has issued a little 8-page leaf key to the common decidous trees of New Jersey which ought to be useful to students of trees not only in New Jersey but throughout the North-eastern States. It costs 10 cents.

In "The Teaching of Agricuture in the High School" G. A. Bricker of the University of Illinois presents a timely discussion of the aims and methods of agriculture in secondary schools. This subject has been so recently introduced into the curriculum that there is more or less confusion both as to how and what to teach. The author recognizes several types of agriculture ranging from that of the agricultural college to that of private secondary schools, and concludes, as all others must who have given the subject attention, that agriculture should be taught as a separate science and not as an adjunct to a course in botany or zoology. He suggests a seasonal sequence in the studies and includes the care and breeding of animals in the general subject. The book, however, is not one to which the teacher can go for directions for carrying on the work of teaching; it is rather a discussion of all sides of the subject from which any teacher should gain many new ideas. The book is published by the Macmillan Company at $1.00 *net*.

The teacher of botany, who, under the demand for agriculture, has been obliged to add this subject to the course, will be glad of a little "Manual of Agriculture" by D. O. Barto, of the University of Illinois, issued by D. C. Heath & Co. This contains thirty-six exercises, mostly experiments, with more or less comment, explanation or direction for each. In the opinion of the reviewer, the book deals with the subjects most worth while in a course of agriculture, and the only adverse criticism that can be offered is that in the experimental part, too little is left to the investigation of the student, a tendency common in many school books, where the edge is taken off the pupil's interest by telling him how the work will come out. The price of the book is 50c.

There are two main theories to account for the origin of the higher types of plants. While everybody now agrees that the more complex type have arisen from simpler forms by some process of evolution, everybody does not agree as to the exact path along which this evolution has progressed. The older theory holds that beginning with the algae, the family line runs through the mosses from some alga ancestor and suggests the origin of the ferns from some such liverwort as *Anthoceros*. The newer theory derives the ferns from the algae direct, and makes the mosses their degenerate descendants. Prof. D. H. Campbell, however, holds to the older theory and in a recent book entitled "Plant Life and Evolution" presents the facts anew for this theory. Although it is the phase of evolution most frequently presented in the class room it has gained a new interest from the lucid and informing style of the author and is well worth reading by even the teaching botanist. Others who still lack a clear conception of how the higher land plants may have arisen may here find a very attractive account of all phases of the matter. The text covers upward of 350 pages and contains numerous illustrations. It is published by Henry Holt & Co., New York, at $1.60 *net*.

It is likely that a good many systematic botanists were much surprised a few months ago by the appearance of a new manual of Botany for the north-eastern states bearing the name of an individual practically unknow to the race of species makers. This unexpected volume is entitled "An Illustrated Guide to the Flowering Plants of the Middle Atlantic and New England States," and was put together by Dr. George T. Stevens. Since the descriptions of the species in the region covered must of necessity be pretty much like those in the two other existing manuals of the kind, we must judge the present volume upon other grounds. First of all its good qualities, then, must be mentioned the eighteen hundred drawings of plants by the author which serve to make the work attractive to any novice who is too much of a scientist to care to use the "How to Know" books and still does not feel himself skillful enough to follow the intricacies of the Brittonian propaganda. These drawings, by the way, are rather more chraacteristic than those that have appeared in the other manuals that lay claim to scientific exactness, and are confined to certain full pages in the body of the book. The descriptions and keys are also for the first time rendered into real Engish and this feature of the work amply bears out the contention so often made that a multiplicity of technical terms are not necessary. In addition to this the first fifty pages of the book are devoted to an outline of structural botany designed to make the identification of plants an easy matter for the student. In arrangement, the book follows the modern sequence and the nomenclature is fairly sane, nor has the author been led away from the facts by a chase after the hawthorns and other elusive "species." There are exactly nine species of *Crataegus* given. Prof. Peck who examined the manuscript before publication says of it that "it comes nearer than any other botanical work known to me to being a satisfactory combination of scientific and popular features." With this opinion most people are likely to agree. The book is published by Dodd Mead & Co., at $2.50 *net*.

"The Story of the Soil" as the title of a book might mean a variety of things depending somewhat upon the author. In the hands of Dr. C. G. Hopkins, Illinois' energetic and efficient soil expert, it becomes a novel in which the hero applies the knowledge learned in school to the practical work of improving a worn-out farm and incidentally gains a wife and "they all live happily ever after." Dr. Hopkins has been writing on soil fertility for many years and has adopted the story form for getting his facts before a lot of people that could not be reached otherwise. It is a sort of sugar-coated treatise on improving the soil and as such is likely to do much good in its way. The book is from the Gorham Press, Boston and sells for $1.50.

The publishers of *Suburban Life* have begun the issue of a new journal devoted to plants under the title of *The Magazine Flowers* the first number of which appeared in January. The mission of the new publication is to supply information about the plants both wild and cultivated. It is edited by F. W. Stack author of "Wild-flowers Every Child Should Know." The magazine contains 32 pages including cover and advertising pages and will be issued monthly at $1.00 a year. The first number is well illustrated and contains several entertaining articles with a foreword by L. H. Bailey. It has much the same scope as *The American Botanist* and no doubt will appeal to our readers.

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The

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Devoted to Economic and Ecological Botany

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THE YUCCA IN DAKOTA

THE AMERICAN BOTANIST

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Rough winds do shake the darling buds of May,
And summer's lease has all too short a date:
Sometimes too hot the eye of heaven shines,
And often is his gold complexion dimmed;
And every fair from fair sometimes declines;
By chance of nature's changing course untrimmed,
—Shakespere.

RED SNOW.

By S. B. Parish.

RED snow was abundant last summer on the high peaks above the Yosemite Valley, so that the members of the Sierra Club, who were enjoying a strenuous outing in that alpine region, had an opportunity of observing a phenomenon rare below the Arctic Circle. It is, indeed, the first time that it has been reported from a latitude so far south on this continent. One of the club members, Mr. Ford A. Carpenter, of San Diego, was fortunate in taking the first autochrome photograph that has ever been made of such a snow field, and it has been handsomely reproduced in a recent number of the Proceedings of the Natural History Society of that place. The Luminere process was used, in which the sun itself records the various colors of the different objects in the scene, and faithfully portrays them in the reproduction.

Perhaps it is not generally known that it is not the snow itself that is red, or stained red, but that the color is due to a plant which grows in the snow, and is of a red color; so that the snow appears red, very much as a meadow appears green because of the grass which grows on it, or a poppy field yellow from the abundant blossoms.

The botanical name of the Red Snow plant is *Sphaerella nivalis*, taking the first part from its spherical shape, and the second from the snow in which it grows. An individual plant is so minute that it is visible only under the miscroscope, but the innumerable millions of these tiny red globules suffice to manifest their color over large tracts of snow. It is of the Algae family, a name which naturally suggests to the mind the delicate sea mosses which grow on the rocks at the coast, the kelp that is cast upon the beach, or the green scums which mantle the surface of fresh water pools. In point of fact the family to one of the largest of all, and comprehends a wonderfully varied series of plants. Many, like the red snow plant, are microscopic in size, but at the other extreme are the gigantic sea weeds of the Sargasso sea, taller, or perhaps one should say longer, than the loftiest *Sequoias* of the California mountains. Some grow in the most unexpected places, as on or in animals, on other plants, on glass, iron, dry rocks, as well as in fresh or salt water. As for temperature no other living organization can endure such extremes. The *Sphaerella* flourishes in the perpetual snow and ice of the Arctic zone, while at the Arrowhead Hotsprings there is an alga growing in water in which one can boil an egg. In antiquity of origin it stands first, for there is every reason to believe that the earliest life which appeared on the slowly cooling earth must have been a minute green alga.

The red snow plant leads a hard life. It occupies only the upper crust of the snow, and to live, it, like all plants, must have water, food and sunlight. So during the nights of the long Arctic winter it remains dormant, but the summer awakens it, with all nature, to activity. Then, even in the coldest regions, the sun's rays liquify a thin film of water on the icy surface, or between the granules of snow. This ice-cold water, and the atmospheric dust which has settled in it, supply to the minute plants their necessary nutriment. They flourish, and multiply by the production of minute spherical zoospores, each of which is provided with a pair of hair-like organs, by means of which it swims about in the ice-cold water, and eventually developes into a new plant. Yet with all this need of extreme low temperatures for growth and reproduction these snow plants, if kept in a dry condition, are capable of retaining their vitality for months, although exposed to comparatively high ones.

Besides red snow there are found, in various parts of the earth, brown snow, green snow and yellow snow, each owing their color to the presence of different algae. Nor does this exhaust the richness of the snow flora, for in all over seventy species of plants grow in snow and ice. Almost all are algae.

SOME DAKOTA WILD FLOWERS.

BY H. TULLSEN.

(*Concluded.*)

MANY and diverse are the species belonging to the pea family that we find in the Great Plains region. The kinds of *Astragalus,* or milk-vetch, are almost without end. In early summer the pretty bluish flowers of the *Psoralea,* or Indian turnip, make their appearance. The roots of this plant are peeled and used for food to a great extent by the Indians and half breeds. The soup, or broth, made by boiling these vegetables with pork I have found very palatable, though the roots themselves are tough and tasteless. As this may be considered one of the most useful of the pea family found growing wild, so the next one to be mentioned is certainly one of the most beautiful, wild or cultivated. Let whoso will boast of his extensive collection of sweet-peas at home, and we shall bear him no envy; for growing wild in exuberant profusion we have a sweet pea (*Lathyrus ornatus*) with which the cultivated kinds, be they ever so varied, cannot compare in the freshness of their beauty. I concede that a white man can do anything and everything—even to the practice of the aboriginal arts—better than an Indian can; but no man, white, black, or red, can improve on nature.

Only in the immediate vicinity of the Bad Lands did I find the white-margined spurge, or snow-on-the-mountains (*Euphorbia marginata*). The bracts and leaves that subtend the umbel of inconspicuous flowers are white-margined, or wholly white, and hence, no doubt, are useful in attracting insects to the flowers and thus helping to bring about their cross-pollination. In the east this spurge is often cultivated in gardens for its handsome foliage, but here, in Nature's vast garden, with natural selection acting as gardener, we can enjoy the beauty of the plants without a thought of labor. They are noticeably abundant by July 4th.

No one could fail to take notice of the prickly poppies which grow along the roadsides at lower levels, especially where gutters have been carved during rainstorms. In similar places we are pretty sure to find the skunk-weed (*Cleome serrulata*) in rank exuberance and with an equally rank smell. Here, too, *Gaura coccinea* is content to abide.

Of shrubs having flowers or flower-clusters more or less conspicuous we have occasionally the June-berry along shaded water-courses; always the choke-cherry in similar places; wild plum, forming dense thickets on the lowlands; trailing *Mahonia*—"waniyetu wahpe," or winter leaf, in the picturesque language of the Sioux—in a few of the deeper ravines; wolfberry (*Symphoricarpos occidentalis*), that luxuriates on all the flood-flats of the creeks; buffalo currant (*Ribes aureum*) overhanging the water from rocky banks; and sand-cherry, a distinctive sand-hill undershrub, overspreading the dunes, and when in blossom filling the ambient air with a splendid perfume. Among trailing and climbing vines there are a species of *Clematis* that tumbles over the brush-piles and fallen trees; Virginia creeper and sweet-scented grape (*Vitis vulpina*), common, both, in the woodlands along streams; and *Celastrus* *scandens,* attractive not because of its inflorescence but on account of its pretty scarlet arils. The stems of this shrubby climber here attain an unusual diameter.

Yucca glauca—"bear-grass" or "soap-weed" is a very interesting xerophyte, or desert-dweller, with its handsome leaves of fadeless green and its racemes of curious flowers. Natural selection has given this plant a glacous foliage with a hard epidermis, and in view of this character the evaporation from the surfaces is very much diminished. The sword-shaped leaves are spiny-pointed, and collectively they constitute a *cheval-de-frise* which effectually repels the attempts of cattle to nibble at them. But these animals are very fond of the clusters of flowers which appear in spring above the rosettes of leaves. Indeed, they wander for miles to procure these tidbits, and it seems strange that any capsules whatever have a chance to mature, for after a little while we behold, all over the prairies, but little of the flower-clusters besides their broken stalks projecting above the assemblage of leaves. Old plainsmen and "bull-whackers" tell us that in former times the buffaloes were equally fond of the flowers, and there is no reason for doubting the statement. Perhaps the bison whose skull and "cross-bones" I discovered one day projecting from the face of a bank beneath four feet of soil at the edge of the Bad Lands had ventured too near the verge when reaching for a bunch of the sweet, savory blossoms, and had been precipitated to his death below—no one will ever know. What puzzles me is the question why natural selection has not been driven to adopt some means to prevent the yucca's flowers from being so generally devoured by herbivores. But no doubt it is through sheer force of numbers that they survive and multiply.

A companion of the yucca in the sand-hills, and to a lesser extent in some places near the Bad Lands, is the bush morning-glory (*Ipomoea leptophylla*) which, as its name indicates, assumes an upright habit instead of the trailing one that the common morning-glory prefers. The flower thus presents to view the semblance of a familiar gem in a strange setting. This plant is "perennial from an enormous root," and each narrow leaf exposes to the air the least surface that is consistent with the proper performance of its functions. It is manifest that we have here a species which has accommodated itself to surrounding conditions in the most admirable manner.

Of the fall flowers, the Compositæ, or the sunflower family, are, of course the predominant type. *Hymenopappus filifolius,* an inhabitant of dry, rocky soil, is with us all summer long, and into September. In July and August the blazing-star (*Lacinaria punctata*) makes its debut, and is more abundant, as I have noticed, in the sand-hills than elsewhere. The purple cone-flower (*Brauneria angustifolia*) is a characteristic autumnal species, although it first comes into bloom about the middle of June. Old settlers tell us that to chew the root of this plant will relieve thirst, and that on this account it was useful to those who crossed the plains in early days. The long-headed cone-flower (*Ratibida columnaris*) also begins to show itself about this time. The ordinary from of this vegetable—with yellow flowers—abounds everywhere, but variety *pulcherrima,* or to the beautiful, with handsome brownish-purple rays, is rather rare. Asters and golden-rods, it goes without saying, are present in myriads, and the species of both are legion.

It is a curious fact that although through the ages hundreds of forms of plant-life have been adapting themselves to the environment of the dry prairies, and can live in the tough sod that the roots of the buffalo-grass have formed, yet when man alters their conditions of existence—makes them prairies suitable for the growth of domesticated productions by breaking the sod, and mayhap watering the soil—many of these vegetal children of the Great Plains will take very kindly to the new artificial environment. Witness the prairie evening-primrose, already mentioned. On the virgin plain it occurs here and there, but in the loose soil of that abandoned field, it forms a rich mantle of white. In such neglected fields, too, I have seen myriads of *Erysimums,* and the rush-like *Lygodesmia,* with beautiful, star-shaped heads of rose-purple, a plant of sparse growth in a state of nature, springs up in lavish abundance and assumes the role of a vile and almost ineradicable weed throughout cultivated tracts near the Bad Lands.

These phenomena might arouse a suspicion in our minds that the plants in this region are not satisfied, as it were, with their environing conditions, and are constantly on the lookout for something better. And this, in a sense is true—the fact holds good throughout all nature. All organisms are ever ready, no matter how perfectly they may be adapted to their conditions of existence, to welcome every new circumstance that will give them an advantage in the struggle for existence. Thus, a plant that chanced to obtain a foothold in a cultivated soil would not be compelled to battle so keenly with other organisms for food and standing-room, nor with inorganic nature, and therefore would have a much better show of developing a large number of seeds, and thus work for the advancement of the species.

The variety in nature, so grateful to our eyes, is an outcome of this everlasting competition for something better that obtains among plants and animals, as well as among men. Now, Pine Ridge reservation being a diversified region topographically,

"Within this limit is relief enough,
Sweet bottom-grass, and high delightful plain,
Round rising hillocks, brakes obscure and rough,
To shelter thee from tempest and from rain;"

and because the nature of the conditions changes rapidly from creek-plain to hilltop, or as we travel from the sand-hills, through the pine country, to the Bad Lands, it is not surprising that the flora is almost endless in diversity and in flower-time surpasses in grandeur that of tropical regions.

Knoxville, Tenn.

HORSE-TAILS AND SCOURING RUSHES.

By Dr. W. W. Bailey.

IT is not alone flowering plants that render spring attractive. Certain near relatives of ferns and, like them, of very ancient lineage are, as early as March, often seen rising like miniature columns, from damp, sandy soil. They are especially fond of rail-way banks and similar locations.

It is the fertile or fruit-bearing portion of the plants that is the first to appear, and it is of a pale brownish color, devoid of leaf-green or chlorophyll. By a lengthened underground stem or rootstock, it is connected with the barren frond, a much-branched, pine-like affair, the real foliage of the plant. It is from the appearance of this verdant, showy part that the name "horse-tail" is derived. Another species, much taller, slenderer, from its rough, silica-covered surface, is called "scouring-rush," and is employed in old-fashioned places for cleansing tin-pans and other articles. This kind, which has only one sort of frond, produces the fruiting part near its apex. This dies off at the end of the season, at the same time giving rise to branches at the nodes, which set out in life as new plants on their own account; one of the cases more or less common, of bud reproduction, supplementing that by seed. The true "scouring-rush" or "shave-grass" is not as handsome as the horse-tail but in a way gives a better idea of its long-ago progenitors.

Far back in geological times, the forbears of the horse-tails, very near akin to our modern lycopods ground-pines, creeping jenny and club mosses, formed large trees, both as to girth and altitude. "They were," says Dana, "lofty woody trees, with scarred trunks and branches." They formed the lepidodendrons and calamites of the coal-measures. The scars seen on their sides are the impressions left by the fronds as they die away at the season's end, as we note in modern tree-ferns like certain *Dicksonias.* As would be surmised from their fern affiliations, they helped to form the vast coal-fields that aid to warm our bodies, afford power to our machines, and deplete our pocket-books in these latter days.

The fertile shoots of the plant, so strikingly suggestive of the columns in Egyptian temples, are formed in the earth long before their appearance above ground. They are hollow and jointed, marked by swellings or nodes. The cylindric portions between one node and another, are called internodes. Such, when closely examined, are seen to be composed of thin, brownish, membranous scales, connected at their bases by rings surrounding the stem, with sharp-pointed, alternate apices. These are the leaves of the plants. The stems proper possess numerous parallel ridges or striae, alternating with the furrows between. Curiously, too, the ridges of one node alternate with those of the corresponding internode, both above and below.

In comparing the fertile frond to an Egyptian column, attention should be directed to the terminal fruiting parts, so like the capitals of these oriental columns. These in the old temples were vermillion, azure, or green. Whether anything in nature suggested the colors, it is impossible to say, but in the glowing lights of the desert, it may have been possible. The whole architecture scheme may be, on our part, a pure riot of fancy, but we have seen pictures of columns recently unearthed in the Nile region, which appear to confirm the notion.

Now let us dissect one of these capitals and observe somewhat the manner of reproduction, curiously interesting as it is to the microscopist or amateur. Horse-tails have no true flowers, that is, of stamens and pistils with or without floral envelopes. The so-called capitals terminating the fruit-bearing fronds vary in form from ellipsoid to more or less cylindrical. If we remove some one of the shield-shaped bodies of which these capitals are composed and examine it with a low-power lens of a compound miscroscope, it will be found to stand on a stalk and to have several long sacs projecting from the inner surface. These are the sporangia and produce the spores, which when ripe fall out in a yellow snuff-like impalpable powder. Each spore is embraced by four coil-like tentacles, the elaters, which cling close to the wall with a spiral twist and with an enlargement at the end. The elaters are very hygroscopic, i. e., subject to change of moisture in the air. When dry they adhere pretty closely to the body of the spore, as if wrapped around it. Merely breathing upon the spores causes each one to unroll. When placed upon the slide of a microscope and then breathed upon, they never fail to cause amusement to all observers as they skip and dance about in most fantastic mazurkas.

Providence, R. I.

MAY FLOWERS WITH LEAF NAMES.

By Miss Nell McMurray.

OFTEN plants receive their names from the character of their workers, the leaves. 'Tis a pleasing custom, for the leaves, commonly, stay with a plant longer than the flowers or fruit.

Our first violet, the yellow *Viola rotundifolia,* may be the first herb in the spring with a leaf name. Some of its sisters come trooping afterward with names similarly acquired. *V. hastata* is, also, an early yellow one that loves the woods and *V. pubescens* appears there a little later. *V. renifolia* is the white round-leaved one, a smooth little plant that springs up in the moist woods. *Hepatica triloba* is so anxious to bloom that it pushes its flowers above the old leaves before its new three-lobed leaves have a chance to grow. Its first name comes "from a fancied resemblance to the liver in the shape of the leaves."

Do not the leaves help name the trilliums? These spring bloomers show a strong liking for the number three, clinging to it when they make their leaves, sepals, petals, stigmas and ovary. First comes *Trillium erectum,* then *T. undulatum* and finally *T. grandiflorum* all enjoying the damp woods.

Mitella diphylla tells of a mitella with two leaves on its flowering stem. One of its dainty flowers suggests a snow crystal, though it has but five rays. The gay little *Polygala paucifolia* comes up in the fence corners and sometime after its purple fringed posies have faded, its leaves assume a purple lining which they retain all winter. In the early spring the old leaves are purple all over, a pleasing change, for most leaves are brightest in autumn.

A colony of *Coptis trifolia,* holding its blossoms above a mossy bed, resembles, at a distance, a patch of white violets. The young three-divided leaves go to sleep at night like the clover—the lateral leaflets folding face to face and the terminal drooping over them. The little plants are easily overlooked, except in blossom time. Though *Tiarella cordifolia* gets its second name from its leaves a more striking feature is the raceme of fuzzy flowers, which suggest the common name of foam flower. Two cousins in the plant world, *Oakesia sessilifolia* and *Uvularia perfoliata* have similar modest, pale yellow flowers, but the foliage differs as their names tell. *Panax trifolium* has three leaves and the leaves are three-divided, sometimes, but often there are five leaflets. Raised above the whorl of leaves, on a naked peduncle, is a small umbel of white, fairy flowers. Gray's Manual says, the tuber "is deep in the ground" but with us it is not so. The tender stem is always eager to leave the nut-like root in the ground, but fingers alone can easily unearth it by digging, not by pulling.

An erect herb stands at the swamp's edge where it must get wet feet, though the part on which it stands resembles teeth more than feet. The white flowers of *Dentaria diphylla* soon wither, but the pair of leaves are there all summer. Near a marsh lives *Arisaema triphyllum,* a big name for Jack-in-the-pulpit, who is ever greeted with pleasure. One may love all plants but there are some we choose for favorites just as best friends are chosen among mortals. A spring without a Parson Jack would be like a fall without a mandrake apple. When one looks upon a bed of *Podophyllum peltatum* the leaves only are seen and the full leaf name seems wise. The plants which raise one umbrella-leaf support nothing else, but the stalks raising two umbrellas are richer. Beneath them is hidden a short stemmed, waxy, white blossom, which gives way to a delicious yellow apple in the fall. Later in the season there are many more blooming plants with leaf names, but some of us love to recall the time "When the lilac-scent is in the air and Fifth-month grass is growing."

New Washington, Pa.

Origin of Naval Oranges.—Dr. Walter Mendelson writes: Will you kindly give in the *American Botanist* an explanation of the "navel" orange—the inclusion of one fruit within another. I recently had such an orange where the included portion was large and juicy but quite bitter (like a reversion to the wild orange) while the outer fruit was edible. This bitterness I have never noticed before—[The navel orange is a bud sport that originated from the common seeded orange. It seems best explained upon the supposition that after the fruit had partly formed, a new growth impulse carried the center of the normal fruit further on. Such phenomena are examples of poliferation. Other illustrations are often found in flowers, where a new blossom may appear from the center of an older one. Examples are not rare in which the young seeds or even the ovules while still enclosed in the ovary have grown out into new plants. In the majority of flowers, the different parts spring from the tip of the stem and are not separated from one another by distinct internodes. There is no reason, however, why the intermodes should be suppressed, and in several, such as the spider flower (*Cleome*), they are not. In the navel orange something similar takes place. Another curious plant in which the seed is borne outside the ovary is the cashew illustrated in volume XI of this magazine.—Ed.]

NOTE AND COMMENT

Wanted.—Short notes of interest to the general botanist are always in demand for this department. Our readers are invited to make this the place of publication for their shorter botanical items. The magazine is issued as soon as possible after the 15th of February, May, August and November.

Queer Mulberry Sprout.—Sometime ago I sawed off a mulberry tree about 4 or 5 inches above the ground and to my surprise I noticed, a few weeks afterwards, a sprout coming up from the center of the stump. It grew to be four or five feet high and was broken off. The tree was about six inches in diameter.—*F. Huber Jr., Jennings, La.*

Grass as a Bleaching Agent.—It is often astonishing to discover how very little we really know about some of the commonest of time-worn processes. Take bleaching, for instance. It will be interesting to compare the answers you get from the first half dozen chemists you ask why the housewife in bleaching cloth insist upon spreading it upon the grass. It is well known that cloth hung out on a line will not bleach well but when placed on the grass there is no difficulty. The reasons given for this are almost as numerous as the persons asked. The unthinking are apt to say that on the grass the cloth gets the more direct rays of the sun, forgetful of the fact that it might be spread on a slanting roof and receive the perpendicular rays of the sun without much effect. The scientist inclines to the view that since nascent or atomic oxygen is a bleaching agent, the oxygen given off by the grass in sunlight is the cause of the bleaching. Others, aware that atomic oxygen almost at once becomes molecular oxygen would go a step farther and attribute the bleaching to ozone, formed by the union of an atom of oxygen from the grass with the molecular oxygen in the air. Still others assert that the grass has nothing to do with it, except to keep the cloth damp and thus enable the bleaching process to go on, since bleaching agents will not act when the cloth is dry. The books are as contradictory on this subject as are the chemists. If anybody among our readers really *knows,* we would be glad to have him come forward and explain for the benefit of the scientists.

LONGEVITY OF SEEDS.—Nobody seems to have definitely answered the question how long seeds can live. We are assured by the scientists that seeds found buried with Egyptian mummies are incapable of germination, and we know as a matter of practical experience that seeds of the common food plants only a few years old can seldom be induced to grow, but the occasional instances of a much longer period of viability in certain seeds makes one hesitate to draw the line anywhere. In a recent *Kew Bulletin* a case is recorded in which the seeds of a leguminous plant, *Albizzia lophantha,* from southern Australia germinated after lying dormant for sixty-eight years. The seeds of different families of plants differ very widely as regards vitality. Those of the Umbelliferae or parsley family, for instance, seldom grow after a few years while species of the pea family (*Leguminosae*) have a reputation for being among the most resistant of seeds. The performance of the Albizzia seeds, here mentioned, quite supports this reputation and extends the range of viability so far that few other seeds seem capable of surpassing it.

THE ASCENT OF SAP.—How the sap ascends to the tops of tall trees in sufficient amount to supply the evaporation from the leaves as well as to form a necessary part of the plant food, has always been a puzzle to botanists. Various theories have been put forth, however, to account for it. Root pressure, capillarity, a sort of pumping action in the cells of the stem, evaporation and many others have in turn been tried and found wanting. The latest and most satisfactory explanation of the phenomena is by an Irish botanist, Henry H. Dixon, who, after experimenting with water in sealed glass tubes has discovered that water has an unexpected tensile strength and under proper conditions will resist considerable stress tending to pull it apart. It requires, in fact, a tension equal to more than 150 atmospheres to sever the columns of water in the ducts of plants. Dixon assumes that the evaporation of water from the leaves sets up a pull of sufficient strength to hold the water suspended in the conducting tracts of even the tallest trees. In elaborating his theory he shows how perfectly adapted to this function the tracheids and other vessels are. Even the partitions across the ducts, which in connection with any theory concerning root pressure and capillariety would only be in the way, by the new theory are shown to be an excellent contrivance for facilitating the ascent of sap.

NATURAL HISTORY OF SELBORNE.—Somewhat more than a hundred years ago, there died in the southern part of England an obscure country parson, Gilbert White, whose name, practically unknown to his own generation, has grown great with the years and is now familiar wherever an interest in natural history prevails. During a long and uneventful life he methodically attended to the duties of his parish and in his leisure hours diligently applied himself to the study of the plants and animals in the vicinity. For many years he wrote letters upon the subjects of his investigations to Thomas Pennant and Daines Barrington and these collected and published in book form a few years before the writer's death formed the famous "Natural History of Selborne." The regard in which the book has been held in England, accounts for the fact that the most important society for the study of Nature in that country—a society numbering some thousands of members—is called the Selborne Society. At the recent annual meeting of this society, nearly a hundred different editions of the famous book were shown and this by no means comprises all the forms in which the work has been issued.

Water Lily Distribution.—Shortly after the water lily flowers are pollinated, the seed capsule is withdrawn beneath the surface of the water where the seeds ripen. The seeds are ultimately released by the rupture of the tissues surrounding them but as the seeds are hard, round and too heavy to float, the prospect of their being distributed very far does not appear to be good until the function of another structure of the plant is investigated. This structure is the aril—an outgrowth from the seed-stalk that grows up and encloses the seed. The scarlet pulpy substance that surrounds the seeds of the bitter sweet (*Celastrus*) and the burning bush (*Euonymus*) are good illustrations of arils. The aril of the water lily seed is buoyant and as soon as the seed pod releases its contents, the seeds by this means are brought to the surface of the water. Upon reaching the surface, according to a writer in *Science,* the seeds separate from one another spontaneously, even though the air and water are perfctly still, and soon make their way to distant parts of the pond or tank in which they are growing. The cause of this movement is as yet unexplained. The writer quoted inclines to the belief that it is due to differences in surface tension caused by substances excreted by the aril. After some hours the aril splits, curls up and the seeds sink to the bottom of the water.

The Remarkable Coontie.—In many of the waste places of Florida there grows an humble little plant known as the coontie, koonti, or wild sago (*Zamia pumila*) which has several claims to the attention of flower lovers. It is a member of the group of Gymnosperms, to which the pines, firs and their allies belong, but is most nearly related to the cycads cultivated in all large conservatories. Though a seed plant, it shares with the mosses, ferns and algae the faculty of producing ciliated sperms, such structures being the rule among the lower orders, but practically absent in the flowering plants where a pollen tube is developed. The fern-like or palm-like leaves spring from a thick structure that seems half stem, half root, and which is stored with starch from which a sort of flour known as Florida arrowroot is produced. The most valued faculty of all, however, is the ability of this plant to obtain nitrogen from the air by means of bacteria associated with its roots. Clover, alfalfa and the legumes generally have long been known to secure nitrogen in this way and thus actually benefit the soil by growing in it, but most plants use up the nitrogen in the soil which then has to be renewed by the addition of manure and other fertilizers. The coontie thus far appears to be the only plant whose roots and stems are used for human food, that is able to improve the soil it grows in, and it thus becomes an important plant to the farmer since it can grow in sterile soils.

XERALEXIS.—The ecologists have always been at a loss for a single word to characterize that faculty in plants commonly known as drouth resistance. We have long had the term *xerophyte* for the drouth plants such as the cactus and yucca that survive with the minimum of moisture and the adjective *xerophytic* is in common use, but no term for this ability to endure drouth has heretofore been proposed. In a recent number of *Science,* however, this omission has been noted, and the word *xeralexis,* from the Greek *xerotes,* drouth, and *alexesis,* resistance, has been proposed. In recent years we have frequently had our attention drawn to books whose chief merit lay in the fact that they used the vernacular instead of the sonorous Latin and Greek of the scientist, but in xeralexis we are introduced to an attempt to reverse the usual preceding. Whether scientists can be prevailed upon to use the term remains to be seen. The Germans, at last ought to look with favor upon it since the term in their own tongue is austrocknungsresistenz.

EPIPHYTES OF THE SEA.—The word epiphyte usually brings to mind thoughts of tropical forests in which the competition of plant with plant for the light is so great that many have been obliged to leave their natural habitat in the soil and take up positions on the trunks and branches of the trees. It is undoubtedly true that the greatest number of epiphytes are to be found in the tropical rain forests, but our own region is not lacking in them as may be realized by calling to mind the many species of mosses, liverworts, algae and lichens that find a situation upon the trunks of trees to their liking. Epiphytes in the sea, however, appear at first glance hardly possible, because there are few seaweeds that grow large enough to afford supports for other species. On our North-west Coast, however, there are submarine forests of giant kelp (*Nerocystis*) in which individual specimens may become more than 75 feet high, or rather, 75 feet long, and on the stems of such specimens many lesser sea-weeds find a congenial resting place. It seems, therefore, that practically everywhere on the earth where large species exist, there are smaller ones ready to make use of their taller relatives in order to get up in the world.

Adventitious Roots.—The common definition of an adventitious root is one that appears in places where roots do not normally grow, but there are a large number of plants in which the possession of adventitious roots of this kind is so regular a characteristic that it is no error to assert that the abnormal has become normal, under which circumstances the adventitious roots are not adventitious roots, or at least belong to a different category from the ordinary roots of this kind. In many plants with climbing or creeping stems, it is not uncommon for new roots to be put out whenever the stem comes in contact with an object. The roots with which the poison ivy, trumpet creeper and English ivy climb belong to this group. Also when a cutting or slip is placed in moist soil, the new roots developed are clearly adventitious. In rhizomatous and bulbous plants, however, the case is somewhat different. Here, at the end of the growing season, the plants very often discard their roots and when another spring comes produce new ones adventitiously. Though they may start in life as seedlings with normal roots during their later years they are entirely dependent upon adventitious ones. Such plants as Solomon's seal, tulips, hyacinths and the like have only roots of this kind. It is also easily shown that at the beginning of their second year, most plants with large tap roots develop a large number of adventitious roots on all sides of the main root. Potato and artichoke tubers also begin their growth in spring by putting out numerous roots of this kind.

CORK.—As most people know, cork is the outer bark of an oak. This tree, known to the botanists as *Quercus suber,* is an evergreen, native to the Mediterranean region, and is cultivated in France, Spain, Portugal, Italy, Morocco, Tunis and Algiers. If carefully done, removing the bark does not injure the tree, and a new supply may be obtained from the same specimen after a few years. We are so familiar with the use of cork for the stoppers of bottles that we seldom realize its manifold other uses, though its connection with bottles dates back only about five hundred years. We so commonly speak of the stopper of a bottle as a cork, that we see no incongruity in the expression "a rubber cork." Just as our word for stopper has been derived from the word cork, so cork itself has probably been derived from the Spanish *corcho* which in turn is derived from the Latin *cortex* meaning rind. Some authors, however would derive cork from *Quercus* the generic name of all oaks. Cork is present in the bark of all trees though in quantities too small to make it useful in the many ways in which cork from the cork oak is employed. The cork-barked elm, the sweet gum and a few others have strongly developed cork.

DOG-BANE RUBBER.—The rubber of commerce is the product of a number of tropical trees and vines which belong to several different families of plants. All contain a sticky juice called latex from which the rubber is obtained. Several of these plant families are represented in more northern floras and like their tropical relatives are characterized by the possession of latex. The fact that exotic species of the Apocynaceae or dog-bane family, especially *Hancornia, Landolphia* and *Funtumia*, produce valuable rubber induced a student to examine the latex of the common dog-bane (*Apocynum androsaemifolium*) with the result that the plant was shown to contain a good grade of rubber. The latex coagulated with acetone gave nearly one-third solids, 3% of which was rubber, much better in grade than the similar product of the milkweed but too small in amount to ever make our common plant a profitable source of rubber. It was also found that the soil has considerable influence on the amount of rubber in the latex, plants from dry hills yielding much more than plants from low grounds. Among other well-known members of the dog-bane family are the oleander, the periwinkle, the amsonia and the plant (*Strychnos*) from which strychnine is obtained.

Character of Desert Vegetation.—One of the most striking characteristics of the deserts of southern Arizona is the diversified assemblage of vegetation forms or life forms which they exhibit. These fall sharply into two classes—the succulents and the schlerophylls—the former of which is represented by fewer species than the latter but is of quite as great importance in determining the physiognomy of the vegetation. Among the succulents may be distinguished the leafless stem-succulent cacti, greatly diversified in size and form, the leaf-succulent *Agave*, the leafy stem-succulent *Yucca* and *Dasylirion* and the root-succulent *Tumamoca*. Among the schlerophylls there are less striking differences of gross form, but equally important distinctions in character of foliage and seasonal habits. As examples may be noted *Covillea* with small evergreen leaves, *Celtis pallida* with broad evergreen leaves, *Prosopis* and *Acacia* with deciduous dissected leaves, *Jatropha cardiophylla* with broad deciduous leaves, *Fourquieria* with ephemeral broad thin leaves, *Parkinsonia* with minute deciduous leaves and chlorophyll-bearing bark and *Ephedra* with leafless chlorophyll-bearing stems.—*Plant World.*

Poisonous Woodbine.—There are few plants in our flora less likely to fall under suspicion that the common woodbine (*Ampelopsis quinquefolia*). Not a little resembling the grape vines, and at least first cousin to these edible and attractive species, it is difficult to imagine it to possess noxious qualities, and yet at a recent meeting of the American Association for the advancement of Science a case in which a child died from eating the berries of woodbine was reported. The poisonous principle was regarded as oxalic acid. Notwithstanding the eminence of the scientist who reported the case, we venture the assertion that something else has been mistaken for the woodbine. Oxalic acid is well known to be present in the toothsome rhubarb and "sour grass" or sorrel but though in much greater quantities than it appears in woodbine, it does no harm. It is much more likely that instead of woodbine the child ate the berries of moonseed (*Menispermum canadense*) which are well known to be poisonous the plant being rather closely related to the tropical plant (*Cocculus Indicus*) which produces the poisonous "fish berries." Moonseed, like the woodbine, is a woody vine and the two plants often grow intervined in the same fence row or thicket. The berries of the two are similar in size and color and one might be easily mistaken for the other by the unscientific. Unless the scientist was able to identify absolutely the berries eaten, it would seem that the woodbine should be given the benefit of the doubt. At the same time, it would be well if someone with the necessary time and skill, would examine more carefully the properties of this well known plant.

Cornus alternifolia.—The red-osier dogwood is much used in shrubberies and on lawns but I do not know that the alternate leaved dogwood has been cultivated, though I think it deserves introduction into our public parks and private grounds. Outside my window and giving pleasure all the year round stands a specimen brought in unwittingly as seed or seedling probably with some ostrich ferns. The snow lies heavy on its roots this March day, but the level branches spreading in tiers from the ground to the summit of what is now a small tree contrast most charmingly with the stiff syringa bushes near by. I think the Indian must have called this the look up tree because the small twigs that bear the flowers and shining pointed leaves all rise from the upper surface of the slender boughs. It is the peculiar delicacy of its spray that makes this cornel a joy in winter, the abundant level-top clusters of creamy flowers a delight in June while in late summer the berries—blue on white stalks—will vary the color scheme and attract bids of different species. Indeed the fruit seems to be very palatable to "our little brothers." The range of *Cornus alternifolia* is wide, extending from Canada to Georgia and from the Atlantic Coast through the middle west.—*Sarah F. Sanborn, Concord, N. H.* [In the region where this magazine is published the only cornel ever seen wild is *Cornus stolonifera.* The flowering dogwood, the little bunch berry and the kinnikinik are as unknown as the cocoanut or guava. Whether other species can thrive in this climate can only be discovered by trial and this the editor hopes to make when he next gets to a region in which such things may be obtained.—Ed.]

The California Thistle.—A certain pestiferous European weed, no less a plant than our old and familiar acquaintance, *Carduus arvensis* has migrated to New Zealand and there, as in other parts of the world, has received a new name and is known as California thistle. Why this well-known European plant should be called Canada thistle in America is something of a mystery but it is no more puzzling than it is to account for its New Zealand name especially as this particular weed has not yet gained a foothold in California. In Europe the plant has many common names most of which allude to its weedy nature. Among those may be mentioned cursed thistle, corn thistle, creeping thistle and hard thistle.

SCHOOL BOTANY

PLANT PROTECTION.

Two societies for the protection of our native wildflowers have been in existence in the United States for several years and have no doubt done considerable to inspire a proper sentiment toward flower gathering, but both have stopped short some distance this side of success, because their efforts have been almost entirely dissuasive. It has many times been pointed out that it is of no real value in flower protection to pledge people not to pick the flowers so long as there are other flower-lovers unpledged. Such a course simply results in one part of the public preserving the flowers until the other is ready to pick them. One cannot, of course, say anything against efforts to bring about a more rational treatment of our native plants, but the fact remains that if the plants are to be adequately protected they must in some way be so surrounded with safeguards that they will not be picked even by those who desire to do so. So far as may be judged at present this can only be accomplished by establishing sanctuaries for the wild-flowers, exactly like the sanctuaries already provided for birds. In the more mountainous and broken parts of our country it is likely that all but the frailest of our wildings will persist for a long time. Such regions are usually too sterile and too steep for cultivation and frequently are too precipitous for pastures. Here the wild-flowers may grow and thrive unmolested. In vast stretches of pinebarrens and sand barrens also the plants are likely, for a long time to come, to have few enemies, but in the vicinity of cities and the large towns, and in agricultural regions where all the land is cultivable, the plant population is threatened with speedy extinction. In such places a campaign of dissuasion, only, seems likely to result in little permanent good. To preserve the plants here, certain enclosed areas in which flower picking of any kind is strictly prohibited must be provided and wild plants elsewhere threatened with extinction must be transplanted into such preserved spaces. In no other way can we be assured that the plants will be properly protected. Fortunately most cities and towns possess parks of sufficient area to make possible the setting aside of small plots for this purpose and all that now seems needed is an organization to take charge of the work and bring it to the attention of the proper authorities. At present there is being formed under the direction of Frank C. Pellett, of Atlantic, Iowa, a society that seems likely to carry out this plan. The new society aims especially at securing grounds in public parks and in other places where the wild-flowers of the region may receive adequate protection. The society is to be organized by states with a vice president and secretary in each and seems designed along lines that will accomplish the end in view. All persons interested in this most worthy object should send in their names to Mr. Pellett. The dues are nominal and only large enough to cover the postage on communications sent out.

Wild-flower Destruction.—In the more arable parts of our country, especially in the Middle West and North-west, the land is becoming so valuable for farm crops and is so extensively cultivated that very little of the native flora is left. In many regions of considerable size the only places in which a few prairie plants still linger are along the remote roadsides and railways. In Illinois the farmers of some sections are advocating narrowing the width of the roads to allow them to use the present roadsides for growing corn. In many places, too, squatters of one kind or another are cultivating crops on the strip of land between the railroad tracks and the fences that bound the right of way. Thus, the plants seem likely to soon be eradicated from the last refuge left to them. It is a curious commentary upon the short-sightedness of railway officials in general that at the same time they are expending much money for exotic shrubs for beautifying the grounds surrounding the stations on their lines, they are ordering some dollar-and-a-half man to get a scythe and cut down all the wild-flowers that may happen to be growing on the right of way between stations. Great clumps of turks-cap lilies, whole acres of painted cup, banks of white anemones, low grounds blue with wild hyacinth or drier slopes covered with lupine, extensive stretches of wild phlox whole galaxies of sunflowers and many other highly ornamental plants that the railroads actually pay for to ornament the station grounds, fall before the vandal with a scythe as if they were so many burdocks or thistles. It would seem that any official with sense enough to recognize the value of shrubbery about the stations would perceive the money value of these floral decorations along the tracks. To be sure the railways embankments must be kept cleared up to prevent fires and to keep untamed nature from taking complete possession of everything but it would seem that the showy flowers might be allowed to bloom undisturbed and if they must be cut that this operation be delayed until the blooming season is past. The man with a scythe ought to be instructed to spare all plants that add beauty to the railway, indeed, it might be possible to engage a botanist to mark with appropriate labels the plants to be preserved. Those who are working to preserve our vanishing wild-flowers might well secure the co-operation of the railways in a matter so important to themselves and to the travelling public as this is.

EDITORIAL

Changes in the fashions are not, as one may be inclined to say at first thought, confined to wearing apparel. They are well-nigh universal and have invaded botany as well as other things. It is no longer fashionable to make an herbarium and the craze for species making is decidedly on the wane. One who does not look much beyond the present or who fails to contemplate the past, can scarcely realize the changes that have been made and are still taking place in the science of botany. A generation ago taxonomy and plant distribution held the center of the stage. Our region was still being explored, new species were being discovered and new names were needed. As soon as the flowering plants became fairly well known there succeeded an era in which the study of cells and tissues, of gross structure and the behavior of plants under various conditions was uppermost, and now this is rapidly giving place to ecology and plant breeding. The flowering plants are now so well known that comparatively little of importance can be gained from their further study and those who are not interested in ecology and eugenics are turning their attention to the simpler plants. This is well shown in the range of papers presented before our various botanical societies. At a session of such a society of national scope, recently, out of the 41 papers presented 34 related to the lower orders of plant life

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According to the latest report of the Department of Agriculture, about a million and a half pounds of vegetable and flower seeds were sent out last year to a more or less grateful constituency by our representatives in the national government. There was a time, when seeds of valuable varieties or seeds true to name were hard to get and when even the seeds of common garden plants were welcomed by the dwellers in the remote parts of our country, but now that we have a large number of up-to-date seedsmen who can supply our wants at trifling expense much better than the government can ever hope to do, the need for a government distribution of free garden seeds has forever passed though our legislators appear not to have discovered the fact. If the seeds sent out by congressional distribution were something out of the ordinary very little could be said against this time-honored custom, but as a matter of fact the seeds are of the commonest varieties such as may be purchased for a few cents at the nearest corner grocery. The free seed humbug originated in a praiseworthy attempt to secure for our citizens improved varieties of vegetable and flower seed, but it has long since ceased to function in this capacity. It is true our government has a large force of experts ransacking the earth for new and valuable decorative and food plants and many have been discovered but these are not distributed to the general public as the free seeds are. The editor has had the pleasure of trying out several of the promising novelties discovered by the government explorers and has a high regard for the efforts of the Department of Agriculture in making new and valuable plants known, but if the free seed distribution cannot, in like manner, supply us with seeds of the more desirable and rare species it seems about time this particular form of legislative activity was abandoned.

BOOKS AND WRITERS.

The *Plant World* formerly of Binghamton, New York, Washington, Denver and Tucson has moved to Baltimore. The current volume has been slightly increased in size and much improved typographically.

Dr. William Trelease, for nearly fifteen years director of the Missouri Botanical Garden recently resigned his position in order to have more leisure for scientific work. He has since been succeeded by Dr. George T. Moore formerly professor of botany in Washington University. Dr. Trelesase has a world-wide reputation as a scientiest and while we wish him all success in his new work we cannot but regret that he is no longer to guide the development of the garden for which he has already done so much.

The Botanical Society of Western Pennsylvania recently issued "Publication 1" which is designed to be the first of a series of annual publications devoted to observations on the plants of the region in which the Society is located. The first issue consists of 32 pages and contains half a dozen articles on plants besides various other items.

A pleasant indication of the value of Green's Vegetable Physiology" is found in the fact that it has gone through two editions in the past ten years, and the third has appeared. In issuing the new edition the author has taken the opportunity to revise and correct many statements in the original work that the lapse of time has shown to be erroneous and some of the chapters have also been rearranged. The book is one of the best in its particular field and no doubt the new edition will continue the good impression that former editions have made. It is published by P. Blackstons Son & Co. at $3.00 *net*.

The recent discussion of pure foods renders a book on this subject most opportune. The latest contribution to the subject is by Dr. John C. Olson whose book entitled "Pure Foods" has appeared from the press of Ginn & Co. After a discussion of what food is, the author takes up the various classes of foods, discusses their values, adulterants, substitutes, cost, etc., and last and most important, gives directions for detecting imprities in the food. This latter should make the book of special value to teachers of cooking, housekeepers and the like. The book consists of 200 pages with numerous illustrations and costs 80 cents.

The pracical and hard-headed agriculturist has ever regarded "book farming" with much contempt. The education of the tender cabbage and the succulent asparagus is, indeed, a matter depending upon fact rather than theory, but the practice of farming is so rapidly becoming a science, that those farmers who have had no opportunity for a study of the scientific principles underlying the cultivation of the soil must perforce turn to books and correspondence courses if they are to successfully compete with the graduates of our agricultural colleges. Nor is the instruction to be obtained by mail, a bit less valuable than the same information delivered by the professor in the class-room. In any case it must be put into practice to be of use. In many cases the instruction given whether by mail or in class, is based upon the same books. Among the favorite volumes for this purpose is "Agriculture" by Prof. Wm. P. Brooks of the Massachusetts Agricultural College. This is essentially a single volume of a thousand pages, though it is divided into three good-sized volumes paged consecutively and devoted respectively to Soils and how to Treat Them, Manures, Fertilizers and Farm Crops, and Animal Husbandry. This work is a classic in its way. It gives in intelligible language, the facts which every farmer must possess to get the most out of the soil and has fittingly been selected as the basis of the correspondence course in agriculture maintained by the Home Correspondence School of Springfield, Massachusetts. It has also been adopted by many schools and colleges as a text book. Prof. Brooks is no mere theorist in farming matters. He has for years been in charge of the four-hundred acre farm of the Massachusetts Agricultural Experiment Station and is familiar with all the details of practical agriculture. Anyone searching for help in solving his special problem will not turn to these pages in vain. Each volume is sold separately for $1.25 postpaid or the three for $3.50.

Every book on farming, gardening or plant breeding must of necessity touch upon the physiology of plants, but commonly they do so only to an extent sufficient to explain the particular matter under discussion. A recent book by Prof. B. M. Duggar of Cornell University takes up the subject of plant production from the physiological side and in consequence throws a new and very different light upon the relation of the functions of plants to growth and reproduction. The book, which is entitled "Plant Physiology with Reference to Plant Production," begins with a chapter devoted to the plant cell followed by several concerned with the water content of plants, absorption, transpiration, water movement and related subjects. Then come additional chapters on the mineral requirements of plants, the uses to which they are put in the economy of the plant, food making, digestion, translocation and the likes. The subjects of respiration, growth, reproduction and the seed each have chapters devoted to them after which come still other chapters discussing the temperature, light and chemical relations which with variation, heredity and growth movements complete the book, covering more than five hundred pages. Following each chapter are directions for laboratory work to illustrate the subjects discussed together with many references to the literature of the subject. The book is illustrated with many excellent engravings and is bound to prove of much usefulness in the class-room in addition to being most entertaining and instructive to the individual reader interested in the principles that underlie plant behavior. The book is published by the Macmillan Company, New York at $1.60 *net*.

Messrs. Doubleday Page & Co., have recently added to their books in the Garden Literature an instructive volume on "Garden Planning" by W. S. Rogers. Though written by an Englishman from an English point of view it is most useful in planning and planting gardens on this side of the world since it discusses the subject from an angle somewhat different from that which obtains in American works. The book is especially full on the semi-artificial side including the making of paths, sun-dials, trellises, summer-houses, arbors, pergolas, fences, terraces, rock-work, hedges, garden seats, bridges and many others. The text is a running commentary on good and bad planting in which the author states his opinions and the reasons therefor. An extensive appendix gives lists of plants for various uses, and many other desirable bits of information. The book sells for $1.10 *net.*

One of the most valuable of botanical works that have appeared in a long while is the two volume "Text-book of Botany" issued by Doctors Coulter, Barnes and Cowles of the University of Chicago and published by the American Book Company. The matter is grouped under the three heads of Plant Morphology, Plant Physiology and Plant Ecology and it is apparent that each part was written by the specialist most familiar with that phase of the work though the product stands in the name of the three authors. No attempt is made to give equal space to each subject and as a result the morphology by Coulter and the physiology by Barnes occupy the first volume, while the entire second volume is given up to ecology by Cowles. As regards the first volume very little need be said except in commendation of its excellence. The matter is arranged in the recognized sequence, the facts are clearly stated and the illustrations are good and for the most part original. In the part devoted to physiology many new facts are found and this rapidly progressing phase of the science is brought up to date by a master of his specialty who, unfortunately did not live to see this excellent piece of work completed. The second volume, devoted to ecology and written by Dr. Cowles is one of the most stimulating and instructive accounts of the subject that have thus far appeared. The matter which fills nearly five hundred pages is treated of in eight chapters, devoted to roots, leaves, stems, saprophytism and symbiosis, reproduction and dispersal, germination, plant associations and adaptations. The author points out that plant ecology may be considered either from the view-point of morphology and physiology or from physiography, and takes up the subject from the first view point as more nearly agreeing with the other parts of the work. He also takes a stand-point unusual to ecological writers and considers his phenomena from the side of mechanical causation rather than adaptation and rejects all terms that seem to hint at anthropomorphic similes. In this advanced position the author declines to admit that flowers have developed in response of insects or that the so-called higher types of plants are any more successful than less specialized ones. Throughout the book the author does not hesitate to take a positive stand in opposition to generally accepted theories when his position appears to be logical. His place among ecologists, however, insures that the information contained in the book is authoritive and up to date. All readers interested in the relation of plants to their surroundings and the causes which have resulted in the species of today will find this second volume, which may be had separately, exceedingly valuable. The two volumes contain nearly a thousand octavo pages and cost $2.00 *net* each.

The addition of Agriculture to the list of studies in the high schools and even lower grades is bringing out a large number of texts designed to fit various phases of the subject. Among new comers in this field is "Productive Farming" by K. C. Davis of the New Jersey College of Agriculture. This makes no pretentions to being designed for the higher grades and therefore does not go as extensively into many subjects as would otherwise be required, but it is well illustrated and clearly written and ought to do much toward inculcating a proper appreciation of farming in the minds of young students. Following the style of most books, consideration is first given to the structure improvement and propogation of plants and this is followed by a study of soils, special crops, gardening and fruit production. Insect and plant diseases are of course, included. Parts I, II and IV are devoted to Animal Husbandry, Animal Products and Farm Management. Part V consists of reference tables. Each chapter is followed by pertinent review questions and a list of references for the further study of the subject if desired. The book contains 350 pages and is published by the J. B. Lippincott Company, Philadelphia at $1.00 *net.*

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AUGUST, 1912

The AMERICAN BOTANIST

Devoted to Economic and Ecological Botany

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WILLARD N. CLUTE & COMPANY

JOLIET, ILLINOIS

PHLOX ARGILLACEA

THE AMERICAN BOTANIST

VOL. XVIII JOLIET, ILL., AUGUST, 1912 No. 3

When zenith high the sun of August burns,
How fresh and cool the frondage of the ferns!
Aisle upon waving aisle behold them stand—
A forest shade for folks of fairy land.

—Clinton Scollard.

PHLOX ARGILLACEA.

By Willard N. Clute.

ABOUT a year ago Mr. James H. Ferriss and the writer described a new species of phlox from northern Illinois under the name of *Phlox argillacea.* When this species is not in bloom it has a superficial resemblance to *Phlox pilosa* and this probably accounts for the fact that it so long escaped the notice of botanists in a region where plant students are abundant.

A glance at the accompanying illustration, however, is sufficient to convince the ordinary observer that this is not *Phlox pilosa.* It is much taller, lighter green, and more floriferous than that species and its season of bloom is both longer and later. Having had the plant under cultivation for some years, we feel warranted in saying that it is well worth the attention of the flower lover and cultivator since it almost exactly bridges the season between the early blooming phloxes like *P. divaricata* and *P. subulata* and the well known plants of various species known to the gardener as late perennial phloxes. The color, too, is such as to recommend it. While the petals are white, the tube of the corolla has tints of purple and lavender in it and the nectar guides, two of which appear on each petal, at the throat, are of the same colors so that while single flowers seem white, a bank of the blossoms gives a tint of very pale lavender. It is thus a valuable addition to the list of garden plants.

The suggestion that this may be an albino form of *Phlox pilosa* is negatived by four important facts: its size is different, its season of bloom is later, its range is restricted and true albinos of *pilosa* occur that are quite different from our plant.

Whether this may be a color sport from *Phlox pilosa* originated by mutation and able to persist in its special habitat through some characteristic that the species does not possess, it is impossible to say at present. We purpose making further investigations in regard to this by sowing the seeds and noting the behavior of the resulting plants. This data, which is certain to be of much interest must be left until the progress of the seasons make its publication possible.

SOME INTERESTING APRIL FLOWERS.

By Dr. W. W. Bailey.

MANY prominent April flowers have this year been driven into May. Thus the dainty innocents or Quaker-ladies have, in the past few days, after sending forth a few skirmishers, at length occupied the fields with their entire force. Usually these charming plants can be looked for hereabouts by April 12th.

Small and modest as these plants are, they belong to a large and important family, of wide distribution. They are of the madders, wherein not only are there many showy herbs, "tiny flecks of flowers," like the galiums or bed-straws, but shrubs like button-ball, *Cephalanthus*, and the Mexican *Bouvardia* seen in hot-houses. The family yields to commerce, besides its title plant, madder, (*Rubia*) coffee and cinchona, two of the most valuable of all vegetable productions, one affording a delicious and stimulating beverage, and the other an all important medicine. It is hard to imagine how man could dispense with either.

Small as are the bluets, they are, in parts of New England, very abundant, and anyone knowing and loving them in childhood, feels a distinct loss if in later life he removes to a section of country, or to foreign parts, where they do not grow. They are never more than a few inches in height, with somewhat square stems and opposite spatulate leaves, the flowers borne in unequal cymes; that is, the first flower to bloom terminal and, to form a complete cluster, this should be balanced by a younger one on each side. As a matter of fact but one of the lateral blossoms developes, leaving a two-flower cluster, in which the upper flower is the older. Before opening, these flowers droop on their pedicels, but later become erect. The four-parted calyx is adherent to the ovary, and thus eventually becomes part of the fruit. From the top of this grows the salverform corolla, four-lobed, with the ovate lobes valvate or touching each other by the edges. It varies in color from deep purple blue, or lavender, to white, with a yellow eye. When a whole meadow is in bloom, it produces the effect of a wide snow-pall.

The pretty herb has been singularly afflicted with both scientific and common names. These seem to be ever in flux. To the English titles already mentioned, may be added a quite erroneous one, namely star-of-Bethlehem. Needless to say this pertains to a quite different plant of the lily family often seen in old gardens. Three generic names, *Hedyotis*, *Oldenlandia*, and *Houstonia*, have been applied to bluets. The last, or Linnaean name, bestowed in honor of Dr. Houston, an English botanist who collected in tropical America, seems now likely to hold.

This plant like very many of its family, (the *Mitchella* or twin-berry, the *Bouvardia*, coffee, etc.,) shows the phenomenon of dimorphism, or two modifications of the flowers of the same species, long observed by botanists and florists, but the significance of which was explained by Darwin, Mueller, Asa Gray and others. The individuals are seen to grow in detached groups or clumps, and if one closely observes these, he will soon note that in one group all the flowers have long projecting stamens and short included styles, while other clusters more or less remote, have the styles project while the stamens are short and included in the tube of the corolla. This is an arrangement to insure cross-pollination, and to bring about perfect results as to vigor and number of offspring. It used to be taken for granted that where stamens and pistils co-existed in the same flower, they necessarily reacted upon each other. Now it is known that in a vast number of cases there must be an interchange of pollen between distinct individuals, of course of the same species. In the late '60s and early '70s this introduced a most fascinating subject of research, and young botanists especially, were delighted with this work. It is a joy to recall that one fought in the line of the early skirmishers.

When such flowers are covered by gauze and insect visitors excluded, either no seed is set, or, as a rule, it is less vigorous, of lighter weight, and not so potent as where insects have free access to the blossoms.

In the same fields where innocents abound, one usually observes also a great profusion of "early everlasting" or "ladies-tobacco," a humble composite which shows distinct, separated sexes. The staminate plants can be distinguished even at a long distance by the rusty-red color of the anthers or pollen-cases. The pistillate have abortive or no stamens, filiform-clubshaped stigmas, and very downy abundant pappus, which finally blows loosely over the fields.

Anyone who even for a few seasons studies the habits of plants, will, among other things learn, that they have their associations with each other, their friendships, possibly even their affections. In some cases given one kind of plants in a locality, you may forecast the almost certain presence of others. Thus, with those already mentioned in this article, one learns to expect the little wood-anemone, the betony, and the bell-worts. The betony or louse-wort, is a member of the great Figwort family, and like many of its congeners, is supposed to be a partial parasite. That is, while it has regular foliage and hence develops chlorophyll or leaf-green, it also attaches itself to the roots of other plants of its environment, preying to some extent upon them. The leaves are fern-like in appearance and the flowers borne in dense spikes. They are decidedly bi-labiate or two-lipped. The upper lip is dull dark ruddy, curved into a scythe-like helmet and two-toothed at the apex. The lower is yellowish. The calyx is bordered with magenta. Generally where there is much of the plant, about an equal number of the specimens are quite yellowish throughout. The four curving stamens are sheltered from rain by the upper lip, and the flower is fertilized by bees and bumble-bees. The plant is not without a certain beauty, and one naturally regrets its most familiar name.

Hereabouts the commonest bell wort is the sessile leaved kind, also strangely enough, known as "wild-oats." It is really of the lily family, with a straw-colored, pendant bell. In a book on our wild flowers we have been amused and grieved to see it illustrated by a picture of *real* wild oats, which of course is a grass. The artist had apparently sown his wild oats, with curious results. Another species is far larger and handsomer, with deep golden yellow convolute flowers, pendant like the other, and with glaucous perfoliate leaves. It is often seen cultivated.

Providence, R I.

SOME MINNESOTA ROSES.

By Lycurgus R. Moyer.

WHILE at Big Stone Lake last summer I collected what seemed to be *Rosa Woodsii* Lindl. on both sides of the State line, some in South Dakota and some in Minnesota. On comparing the specimens with the collections of the botanical survey in the herbarium of the State University at Minneapolis I found that they had no Minnesota specimens. There is a record in the supplement to Upham's Flora, page 47, that this rose had been collected by Miss Butler "near Minneapolis." The Manuals have long given the range of this species as "from Minn. & Mo. to Colo." E. L. Morris, now curator of the Brooklyn Museum, visited this place some years ago, and we collected a rose on the granite ledges two miles north of Montevideo which he was unable to name. It seems to be this same species.

But whether these collections are the true *Rosa Woodsii* may still be an open question. These Minnesota collections differ very little if at all from the rose collected by Heller in New Mexico and distributed as *Rosa Fendleri* Crepin, and marked "authentic specimen from the type locality;" and they seem to be very near to *Rosa Fendleri* as collected by Geo. E. Osterhout at Glenwood Springs, Colorado. Dr. Rydberg in his "Flora of Colorado" is uncertain as to whether *Rosa Woodsii* occurs in Colorado at all, and gives the range of *Rosa Fendleri* as "in valleys and along streams from S. D. and Mont. to New Mexico and Arizona." Some of the roses collected by me on the Missouri River in the vicinity of Mobridge, S. D., closely resemble Heller's New Mexico specimen. Can it be possible that *Rosa Fendleri* extends clear through to Minnesota?

The beautiful roses growing on the banks of the Saskatchewan River at Medecine Hat, Alberta, seem to be the true *Rosa Woodsii* in its thrifty form, while some of the Missouri River roses about Mobridge seem to be the same species, only not so thrifty. In the woodlands along the Minnesota River at Montevideo there grows what is known as the "timber rose," and it has always passed as *Rosa blanda* Ait, in the state reports. The range of *Rosa blanda* has been enlarged in the Seventh Edition of Gray's manual so as to inclue Missouri and Assiniboia, but Bush's specimen from Missouri bears little resemblance to the "timber rose" rose that we have here. The flowers on our roses are usually single at the ends of the branches, occurring sometimes in twos and threes. The stems of our timber rose are almost always covered with weak deciduous prickles which fall away with age, the stems becoming gray. The branches are often free from prickles, and there are no infrastipular spines. I have the impression that the flowers are more often corymbose in the true *Rosa blanda*. Perhaps the rose of our woodlands is *Rosa Sayi* Schwein. Along the edges of the woods there are doubtless natural hybrids between this rose and *Rosa pratincola* Greene, the common wild rose of the prairies.

Botanical specimens of roses should always include a vertical slice from the stem, especially from the older stems, as well as the flowers and, what is more important, the fruit.

Montevideo, Minn.

THE YELLOW BUTTERFLY WEED.

By Willard N. Clute.

Anyone who lives near a stretch of sterile soil is likely to be acquainted with the butterfly weed or pleurisy root (*Asclepias tuberosa*). It seems especially fitted to endure the drouth conditions of sand barrens and clayey hillsides and in such situations its flat-topped umbels of orange red flowers unobscured by the sparse vegation inhabiting such places, makes it one of the most conspicuous of plants for some weeks following midsummer.

I have followed the books in calling the flowers orange-red though this term is far from being adequate. With this, as with many another common species, its abundance and conspicuousness made it easily distinguished by the early botanists who were, in consequence, insufficiently impressed with the necessity for describing the flowers minutely and subsequent manual makers, most of whom have been more familiar with the appearance of the plants in the herbarium than in the field have simply copied the mistakes of their predecessors. An absolutely accurate description of the flowers is probably not to be found in the books reputed to be the arbiters of such matters. In one feature, however, all agree: the hoods are, indeed, "deep bright orange." But the hoods are only part of the flower; exactly half the flower, in fact, when we are discussing color, for the reflexed petals which about equal the divisions of the corona in size are themselves as bright and fully as effective in giving conspicuousness to the flower cluster. These latter parts the books dismiss with scant ceremony; in fact, one of our most authoritative manuals does not even mention them. Those which do are almost as bad for they describe them variously as greenish, greenish orange or purplish orange, when in reality the average plant has orange-red petals that are frequently more highly colored than the hood itself. In the bud the edges of the petals are frequently deep red and while the outer surface may at this time be greenish, the inner surface has more of yellow in it than either. In the open flower the outside of the petal is often deep red. There is, to be sure, considerable diversity in the coloration of individual specimens and it may be possible that some of the flower clusters that in the distance blend into an unattractive brick-red may have more or less green in the petals. In any event, these are not the ones likely to be selected for cultivation or for inclusion in a bouquet of field flowers. By a little careful selection it is possible to secure flowers that are nearly pure red though far behind the cardinal flower or bee balm in the quality of color. Variations in the direction of yellow are also known as might be expected in flowers in which both colors are due to varying amounts of the same pigment. In the yellowish specimens, however, there is practically always sufficient red present to give the flowers a tawny hue and it was something of a surprise, last year, to come upon a plant with clear lemon-yellow flowers without trace of red or orange. This plant, removed to my garden has thrown up numerous stems which during the first half of July were loaded with flowers. Other plants of the same kind are likely to be discovered in any considerable area in which the plant grows, though they are scarcely likely to become common. To facilitate mention of the plant it seems desirable that a form name be given it and I therefore characterize it as

ASCLEPIAS TUBEROSA f. LUTA.

Flowers clear lemon-yellow the reflexed petals tinged on the exterior with orange; otherwise like the type.

The form, *lutea*, is comparable to the white-flowered and white berried forms found in many species though it probably represents a transition stage midway between flowers with the absence of pigment and those having an abundance of it. It is another illustration of the well-known rule that red flowered forms may be expected to have yellow varieties. It is noticeable that yellow flowers rarely produce white or albino forms, though red and black colors are often accompanied by yellow specimens.

THE CACTUS AND THE DESERT.

THE cacti are the most unique feature of the verdant arboreal desert. The man with a camera goes daft over them. Whenever I took a picture, I found myself skirmishing about to see if I could include a tall suhuaro, as the giant cactus is called. If I could not find a suhuaro with its stately branches, like a huge candelbrum, it was usually possible to find at least a spiny, many-branched cholla, the most unmitigatedly vicious of all cacti, or a flat-leaved, harmless opuntia of the prickly pear species. At the time of our journey the cacti were in blossom to our great delight. It would be hard to find any flowers more beautiful than those which form a coronet of white around the tops of the giant cacti and produce a many-seeded fig-like fruit, one of the staples of the diet of the Indian. The slender bells, some three inches long, are not pure white but of a slightly creamy tint. Heavy masses of yellow stamens form a pleasing contrast to the pale petals, especially when a shiny black bee is burrowing for honey. The petals have a peculiarly soft quality, not sticky, but as if the surface had actual depth. The low-growing prickly pear is by no means so aristocratic as the suhuaro, but its wide-open yellow blossoms, shading sometimes to lemon and sometimes to orange, have a very friendly quality. In the flowering season no cacti are so interesting as two closely similar species which have no common name but are known to scientists as *Opuntia versicolor* and *Opuntia spinosior*. They are scraggly branched forms from three to six feet high, with stems of many shades from purple to green. Ordinarily they are unattractive, but when the flowers come out, one is tempted to spend hours in wandering from one to another to see what the color will be. On some plants the flowers are almost green, on others pale yellow, orange or brown. And as if this were not enough, one soon finds plants whose blossoms are bright pink or purple or varying shades of red. A single plant never has flowers of more than one color but one may look at scores of different plants and scarcely find two bearing the same shade.

The cactus has a pronouncedly archaic appearance. It almost seems as it were born with the wrinkles of age in its plump body. All its life it has a somewhat superior air as if its hoard of water were some precious heirloom handed down through countless generations. Perhaps it would seem less like a remnant of earlier days if its acquaintance could be made more readily; but who can really know a plant so armed with spines? Cattle would gladly eat it, but when they attempt to do so, they are almost sure to get thorns in their tongues. Often we saw prickly pears whose leaves had been gingerly nibbled in attempts to get something green and juicy to relieve the monotony of a diet of dry grass which a winter drought had forced upon the cattle from September until the following summer. The cholla and other branching forms are too thorny to be eaten at all by animals. Their loose-jointed branches often break off as the cattle brush past them and hang from their necks or flanks rankling for days.

But the archaic appearance is deceitful. The cactus family is no remnant of a far past age. On the contrary, it is one of the newest of the great families of plants. No real cacti have ever been found in the fossil state. The family seems to have originated so recently that it has not had time to spread beyond the limits of America. From Mexico, which was probably its original home, it has spread northward and eastward, so that one energetic little species of prickly pear is found for away on the sunny side of steep hills in rainy Connecticut; while other species have penetrated far into South America. Most families of plants are much more widely distributed than this and have representatives in both the Old World and the New. The cacti appear to have originated so recently that since they began to spread there has been no land connection of such kind that they could migrate from one hemisphere to the other. To be sure the Mediterranean countries are full of the prickly pear. Everyone who has been in Greece in the autumn has seen venders with two baskets, one full of plump succulent fruits of a yellowish or reddish tint and three or four inches long, and the other seemingly filled with rotten fruit of the same kind. When a buyer comes along the purpose of the second basket becomes apparent. The vender with a dexterous sweep of his knife, strips the skin from a prickly pear and throws it into a basket on his left while the buyer takes the juicy fruit and wends his way homeward undisturbed by the fear of pricking his fingers on the clusters of minute little thorns that stud its surface. The prickly pear is not a native of the Mediterranean countries. It was introduced into Spain from Mexico in the days of the Spanish conquerors and has now spread for and wide. The cactus represents almost the acme of Nature's clever method of adapting living forms to different types of environment. Beginning with species of plants which inhabited the water, she made a tremendous step forward when a few plants learned to live upon land. Since that day the progress of evolution has enabled vegetation to become more and more independent of a permanent and easily accessible supply of water. Our commonest plants take water from the soil even when there is so little that the human hand cannot feel the moisture. As the damper parts of the earth's surface became fully occupied, vegetation spread out into drier regions. In the last age of geological time, Nature has outdone herself. She has produced a plant which can grow to the estate of a lordly succulent tree on mountain slopes so hot and sunny that for months it is painful at noon to touch the heated rocks which project among the patches of the thinnest scantiest soil. The cacti are far from archaic; they are the youngest and most highly developed among the families of plants—the most successful of living forms in the struggle with ardity; the masterpiece of Nature in the greenest of all earth's deserts.—*From "The Greenest of Deserts" by Ellsworth Huntington in Harper's Magazine.*

NOTE AND COMMENT

WANTED.—Short notes of interest to the general botanist are always in demand for this department. Our readers are invited to make this the place of publication for their shorter botanical items. The magazine is issued as soon as possible after the 15th of February, May, August and November.

RARITY OF CONOPHOLIS.—In looking over the February number of the *Botanist* I note on page 10 the statement that "*Conopholis*" or "squaw-root" is extremely rare in the vicinity of Providence, R. I. Here in southeastern Virginia about Norfolk it is very plentiful. There it grows in oak woods; here it grows in the grass along the roadside or in pastures, but always in the open. I have seen them running up to 10 or 12 inches high, and so plentiful as to be quite a conspicuous feature of the surface.—*Ellis B. Noyes*. [The distribution of *Conopholis* seems to be a bit irregular. The editor of this magazine, who has botanized in a good many of the eastern States, has never seen the living plant but once. Can any other reader report it in abundance? *Ed.*]

VANNING IN ENGLAND.—A new form of excursion has sprung up in Great Britain where excellent roads and many points of historic and science interest invite the tourist. The new method of making a vacation tour is a revival of a very old one; no less than travelling by caravan or covered wagon —gypsy fashion. A large number of people who are attracted by this form of excursion own their own caravans while many others fitted up for living and sleeping in the open are offered for rent. The better grade of caravans often cost more than five hundred dollars. There is a Caravan Club interested in promoting travel in this way, and it has issued a list of about 450 desirable camping places in various parts of England. There seems to be no reason, however, why caravanning should remain a source of enjoyment for Europeans only. Our own country contains as many beautiful scenes, but they are much too often seen through a dusty haze raised by the automobile. A roomy wagon—essentially a summer house on wheels—offers numerous advantages over the automobile which has, in fact little except speed to recommend it, but the gypsies are apparently the only ones on this side to be aware of it. Occasionally a company of botanists may make a trip by wagon into an unfrequented region, but a vacation trip by van is still a rarity with us, though it offers one of the best means of studying our plants as they grow.

Coral Reefs Made by Plants.—Whether we have visited the tropics or not, we are, at least, familiar with the idea of coral reefs. It used to be stated that a coral reef is a ridge or mound of limestone built up by the "coral insect." Long ago, however, it was discovered that the animal which forms coral is not an insect, but it is only recently that still more important discoveries have shown us that many, probably a majority, of the ridges reputed to be coral reefs are not made by the coral polyp. Of course all true coral reefs have been made by the coral animal but it now appears that coral reefs are not as abundant as once believed, and that the majority of reefs have been built up by plants instead of animals. Among the Algae, which include the seaweeds, there are a considerable number of species that have the faculty of secreting lime or at least calcium carbonate. The common species of *Chara* are examples of fresh-water forms with this habit and in the ocean are many others notably *Lithothamnion, Goniolithon, Lithophyllum, Halimeda, Phymatolithion* and other species forming the group known as the coralline seaweeds. These rapidly accumulate carbonate of lime and thus build up any ledge upon which they may chance to settle. When such reef-building was reputed to be exclusively the work of corals, the Bermudas were assumed to be largely of animal origin, but now they are said to be principally the remains of plants. The lime-secreting algae are able to thrive deeper in the sea and in colder waters than the corals find agreeable and thus we may account for various coral reefs outside the regions in which corals are active at present. Since the occurrence of reefs has often been depended upon to indicate various geological changes, it is likely that our ideas of these, too, will have to be modified in the light of these recent discoveries. Hereafter reefs will have to be distinguished as coral reefs and coralline algae reefs.

LIPARIS IN COOK CO., ILLINOIS.—On June 18th, 1912, I had the good fortune to find quite a colony of *Liparis liliifolia,* consisting of about 20 individuals, on the bluffs which border Lake Michigan in the vicinity of Glencoe. Aside from the size of the colony, the most remarkable thing about the plants was their surprising vigor, which was well illustrated in the great number of flowers to each inflorescence. The seventh edition of "Gray's Manual" states the number of flowers to each stalk as being from five to fifteen, but three of the largest examples taken from this colony had 25, 37 and 39 flowers each, and there were many with over 15 flowers.—*Edwin D. Hull, Chicago.*

CORONAS AND POLLEN.—Under exceptional weather conditions either the sun or moon may be surrounded by small circles known as coronas. The commonest form of corona is caused by the sun or moon shining through thin clouds of water drops, though similar phenomena may be produced by ice particles in the upper air, or even by clouds of dust driven out of volcanoes. According to *Scientific American* the plants may on occasion play a part in forming coronas. A French scientist has recently noted something of this kind in travelling through a wooded country where the air was filled with pollen from the pine. The corona consisted of rosy rings about the sun shortly before it set. It is well known that when the pines bloom the pollen is produced in great abundance. This is often blown long distances by the wind and when it settles occasionally gives rise to the impression that there has been a shower of sulphur. It seems that on occasion the pollen may also be abundant enough to produce a meterological effect ordinarily attributed to water or meteoric dust.

Pollination in Day Lily.—A good many things in nature are overlooked because they are so common. We think we must study orchids and other rare flowers to observe anything out of the ordinary in methods of pollination when there are plenty of instances just as interesting close at hand. Take the day lilies (*Hemerocallis*), for instance, which are abundant in nearly all old fashioned gardens. Unlike the orchids, salvias, snapdragons and a host of others with corollas variously modified to secure cross pollination, the day lilies have a practically regular corolla which, though turned somewhat to one side is not sufficient of itself to guide the insects along a single path where they may be covered with pollen. Moreover the flowers are ephemeral and in consequence the stamens and stigmas are ready for pollination at the same time. And yet the seemingly impossible is accomplished and the flowers cross-pollinated by an ingenious arrangement of the essential organs. An examination of the flower will show the stamens and pistil projecting from the flower with their tips turned upward. In this position the anthers face the interior of the flower while the stigma extends further outward. When a bee or hawk moth visits the blossom it first blunders against the waiting stigma and it is not until it backs out of the flower that it encounters the stamens and is dusted with pollen.

ABNORMALITIES IN CALOPOGON.—July 4th, 1912, I found *Calopogon pulchellus* blooming in great abundance in an open mossy bog along the Wabash railroad on the outskirts of Hammond, Indiana. Two of the specimens examined showed interesting abnormalities. An extremely vigorous specimen, 48 cm. tall, but with no more flowers than ordinary (10), had two leaves instead of the usual one leaf. The two leaves were of unequal size, however, one being only about one-half the size of the other. Another less vigorous specimen, 36 cm. tall, had two leaves of more nearly equal size, and two racemes, one with two flowers and three buds, the other, not yet in bloom, with four buds. In both racemes there were floral bracts entirely destitute of flowers or buds. Abnormalities like these seem to be of rare occurrence, for out of at least one hundred specimens examined, these were the only two found.—*Edwin D. Hull, Chicago.*

AFRICAN PEANUTS.—We are so accustomed to assume that that fruit which is always so much in evidence on circus day is *the* peanut and the only peanut in the world that it is likely to be a matter of some surprise to learn that there are other species of plants which push their seed pods under ground to ripen. As a matter of fact, there are at least three species of plants with this curious habit. Best known, of course, is our common peanut, ground nut, pinder or goober (*Arachnis hypogaea*) and so closely associated is it with our part of the world that the writer of these lines has seen it in foreign lands labelled "American Steam Peanut." The second peanut is known as (*Voandzeia subterranea*). It is cultivated for food in Togoland, which is not a Japanese possession as might seem from the name but a small country bordering on the gulf of Guinea. From the same general region has recently been described a third species under the name of (*Kerstingiella geocarpa*) and these seem to be all the peanuts known at present. All are members of the Leguminosae or pea family. The latest discovery has a curious habit in the way its fruit is buried. Our native peanut, after flowering, buries its ovary by the lengthening of the flower stalk, but in the new one it is the base of the pistil which lengthens and in so doing pushes the ovary out of the calyx and into the earth.

Tulip Trees.—The tulip tree of eastern America belongs to the magnolia family and is known to scientists as *Liriodendron tulipifera*. Because this name is so commonly used for our tree we might think it the only species so called, but in other parts of the world there are three other trees, all of which bear this name. They belong to the mallow family and are called respectively *Langunaria Patersoni. Thespesia populnea* and *Hibiscus elatus.* The first is the "she oak" of New South Wales and the last is known also as "blue mahoe." All are found in the Old World. Though our tree is known as tulip tree its wood seldom bears that designation being better known as yellow poplar of whitewood. There are, however, seven trees whose wood is known as tulip wood. Two of these, *Harpullia pendula* and *Atalaya hemiglauca,* belong to the Sapindaceae or soapberry family and are not very distantly related to our maples. They are found in Australia. Another Australian tree of this name is *Owenia venosa* belonging to the Meliaceae to which the China-berry of our southern States belongs. In the Philippines is found a tree of the nettle family *Aphananthe Philippinensis* also known as tulip wood which extends southward to Australia. From the same general region comes *Stenocarpus sinuatus* one of the Proteaceae which has no relatives in our part of the world. The Lythraceae, represented by our water willow (*Decodon*), has a species in Brazil, *Physocalymma scaberrima* known as tulip wood. To complete the list *Dicypellium caryophyllatum* one of the Lauraceae may be mentioned. It is related to our sassafras and spicewood and is found in Brazil.

Aralia Trifoliata.—Miss Sarah F. Sanborn writes that there is considerable difference in the size of the ground nut plants (*Aralia trifoliata*) in her vicinity and that only the larger ones appear to be fertile. She expects to examine the plants this spring in order to verify this impression. As we recall the plants the majority of them bear blossoms but it may be possible that only the more robust are able to bring their seeds to maturity. We often too hastily assume that the sole cause of a herb or tree's failing to fruit is a lack of pollen. As a matter of fact many trees, such as plums, fail to fruit though pollinated because their stigmas are not affected by some sorts of plum pollen. In other trees, if too many young fruits set, the surplus fruits are promptly cut off. The editor once pollinated a number of pawpaw flowers in each of which there were several pistils but which commonly ripen only a single fruit for each flower. In this experiment several pistils began to grow, but the plant would not stand for the extra number and cut them off before much growth occurred.

Change of Sex in Arisaema.—It is a fact well known to those acquainted with Jack-in-the-pulpit (*Arisaema triphyllum*) that the character of the flowers varies with the individual in some cases being staminate and in others pistillate or monoecious. Something of the same kind is found in other species of this genus and a Japanese botanist writing in *Kew Bulletin,* asserts of the Japanese *Arisaema Japonicum* and *A. ringens,* that they not only bears the two kinds of flowers on separate plants, but what is most remarkable, that the sex of the flowers varies from year according to the amount of plant food the individual plant has at command. When a plant bears pistillate or female flowers one year it may be made to bear staminate or male flowers the next by curtailing its nourishment. This is quite in harmony with the general law prevailing throughout the plant world that when flowers are of separate sexes, the female flowers always appear on the best nourished plants. In the flowerless plants, also the best nourished plans are always female. Cases are rare, however, in which the sex, once fixed, may be changed by subsequent manipulation though there is some evidence of it in the southern pawpaw (*Carica*).

Color Changes in Flowers.—It is sometimes difficult for the non-botanical to understand how a single substance can produce a variety of colors. For instance, carotin, the substance that gives the carrot its color, is also responsible for the color in many yellow, orange, red and black fruits and flowers. The colors of flowers seem due to comparatively few pigments chemically combined with other elements. A recent study of the colors of the bee-balms (*Monarda*) indicates that a single substance called thymoquinone, may cause all the variations noted in the flowers, the different shades being due to various degrees of oxidation. Most plants contain oxidizing ferments called oxidases which bring such color changes about. In some cases colorless substances in the plant may become colored when combined with oxygen. The oxidases are usually easily destroyed by heat behaving as most plant ferments do under such circumstances.

Herbaceous Grounds.—In the newer botanical gardens it is sometimes the custom to arrange the herbaceous plants by themselves thus separating them from their allies among shrubs and trees. Concerning this, James MacPherson a well known gardener of Trenton, N. J. writes: "Bernard de Jussieu, the uncle of Antoine, laid down a succession of natural groups at the "Jardin Royal de Trianon" during the years 1750-1759. He was the first man to base his work upon sound philosophical rules and his nephew Antoine de Jussieu did much to enlarge upon and complete his system in his "Genera Plantarum" of 1789. He went far to prove that the arrangement by the famous Bernard de Jussieu was sufficient for the classification of vegetation in seven main divisions, and it was according to that classification that the genera and tribes were distributed at the Trianon. The arrangement had the advantage of keeping compact the representation of the groups, and the classical formation of the essential characters only. His tribes were often connected by strong primitive characters and the groups were represented as they exist to day—of course less fully. Each of the groups presented a general set of characters appertaining more or less to all the tribes in the group. By this plan the Dicotyledons were in three divisions, and were provided by Antoine de Jessieu with new groups of a uniform character and more alike as to arrangemetn and terminology.

There was no indication of the so-called "Herbaceous Ground" in Jussius work. On the contrary trees, shrubs and herbs were represented in his groups, and tender exotics introduced from time to time as pot-plants. The Herbaceous Ground is a survival of Linnean arrangements laid down at the Royal Gardens Kew and elsewhere—copying after Pliny who divided plants into trees, shrubs, and herbs,—an arrangement convenient enough in a nursery, but strangely inconsistent and confusing in a systematic garden, which often has plants of all three habits in a genus, such as *Cornus* for instance, scattered from one end of 300 acres to the other in dire confusion!"

SCHOOL BOTANY

The Pleasures of Botany.—The veteran scientist, Dr. Alfred Russell Wallace, recently celebrated his eighty-ninth birthday and in reply to the felicitations of a group of biology students wrote in part as follows: "The wonders of nature have been the delight and solace of my life. From the day when I first saw a bee orchis (*Ophrys apifera*) in ignorant astonishment, to my first view of the grand forests of the Amazon; thence to the Malay Archipelago, when every fresh island with its marvellous novelties and beauties was an additional delight—nature has afforded me an ever increasing rapture and the attempt to solve some of her myriad problems an ever growing sense of mystery and awe. And now in my wild garden and greenhouse the endless diversities of plant life renew my enjoyments; and the ever-changing pageants of the seasons impress me more than ever in my earlier days."

Leaf Skeletons.—The making of leaf skeletons used to be a favorite amusement in backwoods communities and was often classed with the pressing of autumn leaves as mildly interesting pursuits for those who played at studying nature. Properly made, however, leaf skeletons have more than a passing interest. A series of such subjects, well mounted would be an valued addition to the botanical laboratory and to other departments in which plant studies form a part of the course. We give herewith two methods of skeletonizing leaves though we cannot vouch for their effectiveness from personal knowledge. However, they look workable and our readers may care to experiment with them. By the first method the leaves are placed in boiling water for two minutes and then transferred to a strong solution of permanganate of potash until the pulpy part of the leaf can be washed out or removed by brushing with a soft brush, leaving the veins. The second method recommends treating the flowers for a time with one-eighth strength nitric acid and when the tissue may be easily brushed out placing them in weak ammonia. The specimens may then be bleached with peroxide of hydrogen in sunlight. For beginning experiments it would probably be best to select leaves with stout veins since the process depends upon tearing down the green cells of the leaf by chemicals before the veins are affected. If any of our readers knows of a better process than those given we shall be glad to publish it for the benefit of all.

Changed Views in Botany.—Ten or fifteen years ago, the general idea conveyed by the word, botanist, was that of an individual skilled in the methods of naming plants and active in amassing a collection of dried plants for his herbarium. The march of time, however, is fast leaving the mere plant collector and plant namer in the rear. Once the species maker was almost venerated; now he is clearly on the defensive as a wail from Dr. P. A. Rydberg in a recent number of *Torreya* indicates. This versatile scientist writes: "Not long ago, all botanical work done in this country was taxonomic work, usually known as systematic botany, although much had, indeed, little of "systematic" in it. Now it is different. Courses in taxonomy are almost excluded from the curricula of many of our coleges and universities, or if not excluded, so little esteemed that students are discouraged from entering upon them. The taxonomist, whether a systematic botanist in the true sense or a phytographer, is looked upon by phytogeographers, ecologists, physiologists, cytologists and morphologists as of a lower grade of stuff;—as if it took a less fine grain of brain to make a first class systematist than any other kind of an ist."

Place of Experiment in Botany.—When I want to learn all that I possibly can of a new country, I visit it if I can do so, and see all I can of it, but I do not hesitate to use maps and read books pertaining to the country. I may even ask the people who have lived there longer than I to tell me all that they know. In this way I build up my knowledge of the country and it is good and reliable, far more so, perhaps, than if I had relied wholly upon what I could have seen personally. And so it is in Botany. I must surely see as much for myself as possible, but life is quite too short for me to hope to see all that is known with my own eyes. Here and there, at critical and strategic points, I must see for myself and then I can go a long way, when I must again get my reckoning by observation. The mariner does not sail the seas by doing nothing but make mathematical observations. It would be slow sailing indeed were he to do so. And yet this is what some of the bookmakers are planning to have the children do—they are to learn everything about plants by the experimental method. They lose sight of the fact that there is no special saving grace in the labor of making experiments. We make experiments on plants in order that we may learn botany. We do not learn botany in order to make experiments on plants. Let every teacher remember that useless experiments involve as real a waste of time as dawdling or idling. I can walk from Lincoln to Denver, but it takes so much time that it will pay me far better to be carried there on a railway train.—*Prof. C. E. Bessey in Science.*

The "Peg" in Curcubits.—The path that leads from solid fundamentals into the mazes of exception and individual peculiarity in botany is one that is easy to mistake for the right one and many good teachers are lost therein. A good illustration of this fact is seen in the importance that some teachers ascribe to the peg in the seedlings of the gourd family. The peg, as most students are aware, is a small projection on the side of the young stem or caulicle which, when the seedling begins to grow, engages one side of the testa and aids in prying it open and allowing the young plantlet to escape. This peg, however, seems to be a peculiarity of the gourd family and by no means the usual thing in seedlings, yet botanical texts are still having difficulty in omitting references to it. It is, to be sure, an interesting structure but no more worth studying in an elementary course than many another individual peculiarity. A study of the squash or pumpkin seed usually formed part of the ancient course in botany but that was before we had decided what is fundamental in the study of seeds.

TEST FOR CANE SUGAR NEEDED.—One of the first tasks set the beginner in botany, zoology or physiology is the testing of various foods for starches, oils, porteids and sugars. Most of these are easily made and give saitsfactory results until one comes to the sugars and then trouble begins. It is easy enough to discover the presence of grape sugar by the well known test with Fehlings solution, but nobody seems to have designed an equally facile method of showing the occurrence of cane sugar though it often occurs in plants. To be sure if a thing tastes sweet and a test for grape sugar shows no grape sugar present, we may *assume* that the sweet is cane sugar but we have not *proved* it. All we have shown is the absence of grape sugar. It is possible that a given liquid to be tested might be poisonous and so not to be tested by taste. Under such conditions the discovery that no grape sugar was present might lead to the assumption that no sugar was contained in the liquid. Cane sugar seems more difficult to identify than most common foods, but we submit that if substances are to be tested for other foods, they should be tested for cane sugar also.

EDITORIAL

On many occasions we have been led to comment upon the propensity of the average newspaper reporter to build an impressive story about plants upon an exceedingly tenuous basis of fact, but our astonishment at such feats of the pen is as nothing to our admiration of the reporter's ability in getting some of these stories past the editor who is usually supposed to be a man of some brains and ordinary common sense. Time and again in the lay press we come upon blood-curdling stories of plants that deal out death to all who approach—Upas trees, man-eating plants, the vulture lily of the East Indies and many others that fail to impress the botanist but which appeal to the credulity of the general reader and by catering to this belief in the marvellous spoil his appreciation for the wonderful things about plants that are true. The latest contribution to the pseudo-science of botany is entitled the "Death Orchid" and runs as follows: "Three years ago, an orchid hunter, Grayson set out to find 'El Lugor de los Flores Venenosos,' that is 'The Place of the Poisonous Flowers,' which was said to be located in the dense and pathless wilderness occupying the vast stretches between the head waters of the Orinoco and the Andes. One morning there was a perceptible smell of flowers in the air. When the orchid hunter and his Indians camped that night the jungle smell had been entirely lost in the cloying scent. Many of the band refused to go further. As Grayson and the others proceeded the rankly sweet and oppresive odor became stronger, attacking the senses like a narcotic. The orchid hunter felt as if he were being attacked by the insidious power of opium, but retained enough consciousness to become aware that, gleaming through the trees ahead he saw flowers of huge size and vivid colors; many hued clusters of them hanging in trails. It was the death orchid! When he recovered his senses, he found himself being carried back to camp where the rest of his porters had remained. Many of the band were severely sick and many half witted with the continued effect of the scent." The botanist who reads this account is likely to wonder whether the story was not written up by one of those half-witted members of the party. It would have required some such condition of mind, we are inclined to think, to perceive the headwaters of the Andes. But the query which sticks longest in mind is, why should anybody take the trouble to make up such preposterous stories when a multitude of the wonders of the plant world are still to be adequately described.

* * *

We regret to announce the demise of *The Magazine Flowers* which was begun under very auspicious circumstances early in the year but which was discontinued after the issue of four numbers. The magazine was much like *The American Botanist* and backed by a publishing house with large resources we were led to hope that it would be able to do more for the science than we have been able to accomplish, but no equipment seems adequate to negotiate the almost impossible task of issuing a successful—a financially successful—magazine of popular botany. The new magazine has become a department of *Suburban Life*. Its retirement from the field leaves our magazine alone in its chosen field again, but jogging along in the same old way. When we note the successive surrender of one out-door magazine after another, we often wonder whether there ever will come a time when the general public will forsake nickel theaters and moving picture shows for the more satisfying pleasures of the study of nature. Meanwhile we continue doing what we can to awaken an interest in such things being possessed of much of the spirit of the Irishman who hearing that parrots often live to be 200 years old bought a specimen with the intention of proving the matter by experiment.

BOOKS AND WRITERS.

"Popular Garden Flowers" by Walter P. Wright is exactly what its name indicates, a book dealing with the popular flowers of the garden and not a book attempting to popularize flowers in general. About forty groups of common and familiar plants and considered beginning with anemones and asters and running through the alphabet to end with roses and tulips. Since all the important species in each group are discussed the book is one of nearly four hundred pages. The method of treatment involves the history poetry and folk-lore of each species, notes on its cultivation in doors and out and more or less discussion of the form and coloring but without any very formal botanical descriptions. It is just such a book as one might desire who, having a flower garden would like to learn more regarding the origin and evolution of his specimens. Its one defect, in the eyes of some Americans, is that it is written primarily for British readers. A number of good illustrations, six of which are in color, add attarctiveness to the work. It is published by Doubleday Page & Co., at $2.50 net.

When one selects a guide in any undertaking, he carefully investigates, if he is prudent, the qualifications of the candidate for the business in hand. Looking at Harpers recently issued "Guide to the Wildflowers" from this angle we are disposed to question its usefulness. And yet the book comes close to being an important addition to our list of wildflower guides. The one great defect is the lack of an adequate key. As arranged the species are grouped according to color and the species of each group follow a definite sequence from simple to complex, but one can imagine the trials of a beginner who, finding an unknown yellow flower must search through ninety-six pages of description to find its name with little to guide him except various dubious pen drawings.

Similarly an unidentified white flower might require the consultation of more than a hundred pages. Concerning the drawings we may note that the one labelled *Drosera rotundifolia* is certainly not that species. Following the part of the book devoted to the descriptions of species there are lists of plants according to habitat and also according to the seasons in which they bloom, but everywhere the lack of a key—which is merely a labor saving device—is evident. In the introductory pages we note here and there slips such as the statement that "white flowers which cannot attract insects by their bright colors, are apt to be strong scented." As a matter of fact, white flowers probably attract insects more successfully than most others. Among the book's merits are its use of the standard nomenclature, the accented scientific names, the untechnical language in which the descriptions are given, and the amount of information of a popular nature concerning each species. Though somewhat unsuited to the beginner, the book will be found of interest to older students for the amount of general information about plants which it contains. It was compiled by Mrs. Caroline A. Creevey author of "Recreations in Botany" and "Flowers of Field, Hill and Swamp." The illustrations used are largely from the latter volume. The book is a 12mo. of over 550 pages and costs $1.75 *net.*

We fail to see how the title of "Elementary Plant Biology" given to a little book by James Edward Peabody and Arthur Ellsworth Hunt is appropriate for the subject it discusses To be sure the study of plants is a part of biology and a book for beginners must be elementary. The trouble seems to be the effort to connect the book with that magic word, Biology, which is having such a vogue at present with those who would supplant the study of botany and zoology in the public schools with "something just as good" as the druggists and other retailers are accustomed to say. "Elementary

Plant Biology" is really an excellent little botanical manual for the laboratory study of plants mainly from the standpoint of function. It begins as all such manuals should, and few do, with some preliminary studies in common chemical processes, and then takes up the subject of beginning botany under such heads as the nutritive organs of plants, reproduction in plants, plant propagation and the like. Throughout the book the study is carried on largely by experiment and the principal criticism of the book must be directed against some of these experiments which appear to be either not of enough importance to warrant their inclusion in such a book or rather more extensive in some points than seems necessary. As in all other manuals tests for fats, starches, proteids and grape sugar are given, but there is none for the often abundant cane sugar. We note, also, that many of the experiments are to "prove" or to "demonstrate" rather than to "discover," though the difference is of much importance. Some of the experiments prove altogether too much or perhaps nothing at all. The book should be of great helpfulness to teachers for the reason that the instructions for performing the experiments are clearly given and the experiments, themselves, are so numerous that a selection is readily made. The endeavor to connect the functions of plants with the welfare of man is also commendable. The book is also well illustrated. It is published by the Macmillan Co. at 75 cents *net*.

There is probably a better reason for the general public to study the trees than other forms of vegetation. The trees are the most permanent of plants. Some that are still green and thrifty were already strong and vigorous trees at the beginning of the Christian era, and there are few of the less enduring that do not outlast the life-time of puny man. When the mature man returns to his boyhood home, the constituents of the scene that have changed the least are the trees. Moreover, the trees have an individuality about them that is most pronounced—an individuality that makes them recognized even at considerable distances, while the number of different species is so small that the non-botanist may hope to learn to recognize them all. There may be some excuse for the adult human being who cannot name all the wildflowers, but there should be none at all for one unable to name the trees of his vicinity. And the chance for an excuse is yearly growing smaller because of the number of books on trees, from all sides of the subject that are steadily appearing. Two new tree manuals have recently come from New England both excellent in their way and each adapted to a different season. "New England Trees in Winter" is issued by the Storrs Agricultural Experiment Station of Connecticut and is the work of Professor A. F. Blakeslee and C. D. Jarvis. The authors contend that the tree in winter is far from being the characterless object it is assumed to be by the uninitiated and in the 250 pages of the bulletin fairly establish their claim. There is a full page illustration for each species showing photographic reproductions of the bark, twigs, fruit and seeds as well as an illustration of the tree as a whole in the winter condition. The illustrations alone ought to be ordinarily sufficient to identify the specimen but in addition, a page of text carefully gives further descriptive points under the heads of habit, bark, twigs, leaves or leaf scars, buds, fruit and wood. The distribution in the United States, in New England and in Connecticut is given and each species is compared with those that in any way resemble it. One hundred and eleven trees are thus described. In addition there is a very good key by which a given species may be traced. Such a book is bound to add zest to the rambler's winter outings, and is expected to be of much value in supplying teachers with material for nature study at a season when it is most difficult to obtain. The book is designed primarily for Connecticut teachers, but probably copies may be obtained by others interested. The second tree book is entitled "A Key to the Trees" by J. Franklin Collins and Howard W. Preston and is based primarily upon leaf characters. Outline drawings of the leaves of all the trees are given and in most cases small photographic illustrations of the bark, also. Unlike most books of this nature the key runs entirely through the text. The leaves are exactly described, and in addition there is considerable information about the flowers, fruit, twigs and bark. To the reviewer, the key appears a trifle involved, and it would seem that it might be enhanced in value of broken up into several keys to smaller groups. It is likely, however, that the average student will have little trouble on this score, especially since the language of the key is decidedly untechnical and the volume is of a size to fit into the pocket and so destined to be used in the field where plenty of material for identification is available. The book is published by Henry Holt & Co., New York at $1.35 *net*.

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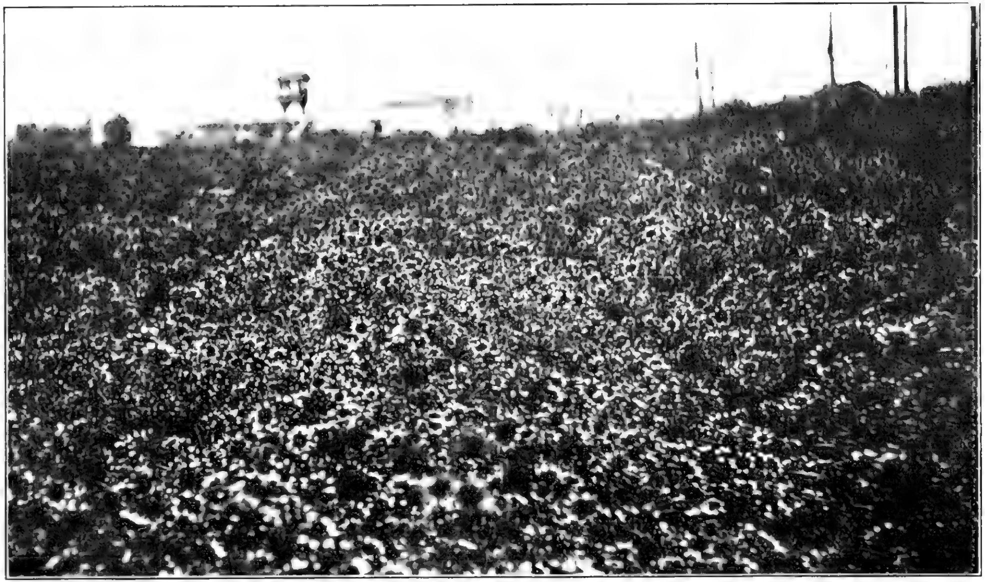

TICKSEED SUNFLOWER ON THE CHICAGO PLAIN

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The elm lets fall its leaves before the frost,
The very oak grows shivering and sere;
The trees are barren when the summer's lost,
But one tree keeps its goodness all the year.
Green pine, unchanging as the days go by,
Thou art thyself, beneath whatever sky.

—Augusta Webster.

THE SUMMER FLORA OF THE CHICAGO PLAIN

BY WILLARD N. CLUTE.

THE flora of the Chicago Plain is essentially a prairie flora. In spring the relationship is somewhat obscured by the occurrence of various species that can live in any moist soil, but as midsummer approaches the strictly prairie species appear in ever increasing numbers until there is no mistaking the character of the vegetation. The region, however, is not a typical prairie. The soil is a deep and almost impervious clay that was laid down as a soft mud in the bottom of a shallow lake that covered the region during the glacial period. Upon the recession of the waters of the ancient lake, the plants began to spread in from adjacent regions but the prairie species appear to have been those best adapted to the plain and they have held their ground ever since.

The changes which the region annually undergoes must be rather trying to many species and have no doubt served to discourage the invasion of the area by plants adapted to other situations. In the spring much of the surface reverts to its primitive condition and becomes a series of shallow lakes, but at the height of the growing season the other extreme prevails and the surface becomes hard and dry. Even the swamps that in spring seemed impassible at any time of the year now afford a firm footing and allow the botanizer to explore their inmost recesses. The rays of the summer sun beat upon the plain with relentless force and the rising air creates lively breezes that call still further for the moisture that the plants find none too abundant in the stubborn soil. Only plants that can endure being half drowned in spring, baked and dried in summer, and frozen in winter can survive long on the Chicago plain.

The type of vegetation that has resulted from such conditions is a very characteristic one. Nearly all are perennials with stout tap-roots extending deep into the soil and coarse stems and leaves, the latter often leathery in texture, covered with hairs wax or other protection against complete dessecation. Those that do not possess taproots, usually have some sort of underground stem, from which the upright stems arises. No shrubs are found.

At first glance the plant covering may appear nearly uniform, but a little investigation shows that there are two groups. These the ecologist recognizes as the high prairie and low prairie associations, respectively. The high prairie types occupy the crests of the low swells, especially where the soil inclines to be sandy, and thus approach desert and sand barren types of vegetation. The low prairie types are found in richer soil where the swampy areas merge into drier ground. There are, to be sure, plants common to both regions, just as some weeds can thrive both in cultivated fields and waste land, but enough species are found in a single area, only, to cause a decided difference in the appearance of the two groups. Often in the course of a few hundred feet, the observer may thus pass from one fairly distinct flora to another without any very noticeable change in the physical surroundings.

In regions where the conditions of life are hard—on mountain tops, in deserts and in the Arctic regions—plants usually display an abundance of flowers and these of a size quite out of proportion to the vegetative parts. On the Chicago plain a similar condition prevails. Throughout the growing season, the region is more thickly spread with bloom than any other within a radius of many miles. Great masses of a single color stretch away to the horizon and the transient visitor might jump to the conclusion that only a few species inhabit the region, but this only illustrates the fact that each species has its particular season of bloom. Wave after wave of color sweeps over the spot as the summer waxes and wanes, each spending itself after a few days or weeks but leaving behind it little eddies and splashes of color that flash in out-of-the-way places for some time longer. Occasionally two species come into bloom at the same time and then the surface takes on a mottled appearance as one group vies with another. Not all the characteristically prairie species, however, are gregarious enough to produce such displays. Many seem to prefer existence in isolated clumps, and it is the chance of encountering these that lends zest to the exploration of the region.

With the exception of grasses and sedges, the monocotyledons are not abundant in the area. Only three species are plentiful enough to give a note of color to the scene. These are the spiderwort, star grass and blue-eyed grass. The least specialized dicotyledons are also few in numbers. Fully one third of the species represented belong to the dominant group of composites while a still greater proportion of individuals are of this alliance. A list of all the plants growing in the region would be too long for inclusion here, but a list of the more conspicuous is given. Riding across the region, these are the ones likely to be seen and recognized. It is only when explorations are conducted on foot that less conspicuous species appear.

LIST OF SPECIES.

Tradescantia reflexa. Spiderwort.
Potentilla Pennsylvanica. Cinquefoil.
Baptisia leucantha. False indigo.
Petalostemon purpureum. Prairie clover.
Polygala virescens. Milkwort.
Euphorbia corollata. Spurge.
Hypericum mutilum. Small St. John's wort.
Hypericum gentianoides. Poverty grass.
Eryngium yuccafolium. Rattlesnake master.
Apocynum cannabinum. Indian hemp.
Asclepias verticillata. Narrow-leaved milkweed.
Asclepias viridiflora. Green milkweed.
Asclepias incarnata. Swamp milkweed.
Phlox pilosa. Downy phlox.
Phlox glaberrima. Meadow phlox.
Verbena hastata. Blue vervain.
Pycnanthemum lanceolatum. Mountain mint.
Monarda fistulosa. Wild bergamot.
Stachys palustris. Hedge nettle.
Physostegia Virginica. Obedient plant.
Veronica Virginica. Culver's root.
Vernonia noveboracense. Ironweed.
Rudbeckie hirta. Black-eyed Susan.
Coreopsis tripteris. Tall tickseed.
Silphium terebinthinaceum. Rosin weed.
Silphium laciniatum. Cut-leaved compass plant.
Helianthus giganteus. Sunflower.
Helianthus occidentalis. Western sunflower.
Bidens trichosperma. Tickseed sunflower.
Solidago rigida. Showy goldentod.
Ratibida pinnata. Gray cone-flower.
Liatris pycnostachya. Blazing star.
Achillea millefolium. Yarrow.
Lactuca Canadensis. Wild lettuce.

THE GLORY OF THE MORNING.

By Dr. W. W. Bailey.

I NEVER see a morning-glory without envying the bees who can plunge into its cool pavilion. How exquisite is the texture! How alluring the color; deep purple, pink, violet, or red. Its evanescence, too, adds to its beauty. Anything ephemeral thus appeals to that feeling in man which leads him to protect the weak and innocent. After blooming the flower closes permanently by rolling in upon itself in a fashion most beautiful.

"Where is that Promethean heat
That can its light relume?"

The opening of morning-glories at a relatively fixed time of day—certain species like the moon-flower (*Ipomoea bona-nox*) only in the evening; others as constantly matutinal—recalls Linneaeus' experiments in making a floral clock. We recall certain plants with precise habits as to time of opening; four-o'clocks (*Mirabilis Jalapa*), evening primrose (*Oenothera*), certain catchflies (*Lychnis*), the common chickory, and night-blooming cereus, or its cousin more commonly passing under its name—the *Phyllocatus*.

The chickory one finds abundantly about Boston. Its blue heads close—vanish—by noon. Every botanist realizes that to have them complete he must catch some flowers, early in the morning, such as rock roses (*Helianthemum*) bloodroot (*Sanguinaria*), the common celandine, etc. In the last two, and in poppies, the calyx is caducous; that it, it falls as the bud expands. Beginners analyzing such plants are, if they find them at mid-day, apt, to their dire confusion, to think them apetalous.

But to return to our morning-glories. Our garden species, varying so much in color, belong to the genus *Ipomoca.* The wild bindweeds, on the contrary are *Convolvuluses,* distinguished at once by a sort of additional calyx and a perennial habit. The larger species, *C. Sepium,* is a free twiner, very beautiful in the fields and with an added beauty near the sea-shore where the flowers assume an exquisite pink hue. When cultivated they are apt to become white. Why?

If introduced into the garden, it for the first summer fills one with joy from its beauty. The next year it is found to be an exquisite nuisance as it spreads by its underground stems. It will soon fill an entire yard, crowding out everything else, unless it be the wild cucumber, which is even more aggressive. One has to wage upon them an unrelenting war. They pitch their tents, I am referring now to the bind-weeds, with no regard, apparently, to picturesque or strategic position.

A smaller species, *Convolvulus arvensis,* turns up in fields or abandoned lands. It has small white flowers and though of European origin appears to be perfectly established.

Little *Convolvulus spithamaeus,* six to nine inches high does not twine but it is erect or ascending merely. A very charming convolvulus is *C. tricolor* of gardens with blue corolla merging toward the center into pale yellow and finally white. This, too is a non-climber. Cypress vine (*Ipomoea quamoclit*) a west Indian or tropical plant has very delicate pinnate leaves and a small scarlet or white trumpet shaped corolla.

The moon-flower, before mentioned comes from tropical America, but appears to be native, also, in Florida. Its large fragrant corolla, has green folds and is salver form. It twines high and rapidly but the New England season is hardly long enough for us to see it in perfection; at least, such is my experience, in growing it out of doors. The sweet potato is another species of *Ipomoea* and has a handsome purple funnelform flower. The origin of the plant, as is usually the case with those used for food, is unknown or conjectural. Cuba is an island abounding in Convolvulaceae. I remember once, in looking over the collections of the late Charles Wright, being astonished at their number and variety. We should expect to see some fine plants introduced from that fair land, now our ward.

Providence, R. I.

CHARACTERISTICS OF OUR FOREST TREES.

THERE is an individuality about the trees that is not found in any other members of the vegetable kingdom. The wayside flowers may charm us for a season but in the course of another year or two they are gone, their places taken by sturdier neighbors who have out-stripped them in the race for supremacy and elbowed them aside. But the tree represents something more stable and permanent. The larger and sturdier specimens in any locality began life before any of the human inhabitants were born, and our country does not lack for specimens whose origin antedates the appearance of the first white man. Something of the permanancy of the hills, cliffs, and streams, seem to invest these mighty vegetables, exalting them above the condition of common plants. The personality of the tree made a deep impression on the imaginative mind of primitive man and it is small wonder that he peopled the forests and groves with spirits and regarded each specimen as harboring a nymph or dryad whose life ended with its life.

While the trees are in many ways distinctly separated from the rest of the vegetable world, they are no less sharply distinguished from each other. The woodsman can single out and name the different trees in the landscape almost as far as the eye can reach, and we, with less of his skill, can still separate each species on closer inspection. In the mere matter of bark there are endless variations from the rough and splintery bark of the well-known hickory or shagbark to the smooth, cool bark of the beech, hornbeam and aspen or the coarse bark of hemlock and pines. The method by which each species of tree throws off its bark is a method all its own. The differences is often considerable even in the same family. Witness the rough heavy bark of the rock oak as compared with the thinner smoother exterior of the white oak. The bark of the ironwood is fine and stringy and the older the tree grows the finer this bark becomes, while that of the buttonwood comes off in thin flakes and the tree usually looks as if white-washed. The curly papery bark of the birches is well known. That of the black and yellow birches contains so much oil that experienced campers always use it on rainy days in kindling a fire. The day must be wet indeed when bark from the under side of a leaning birch tree will not burn. Touch a match to this papery bark on a standing tree some day next winter when the ground is covered with snow and danger from fires out of the question. The orange colored flame will mount up the bole of the tree as long as there is anything to feed upon and form a most beautiful picture in the quiet woods. The burning of this outer bark does not injure the tree in the least, in fact all exogenous trees—those that grow by annual additions to the outer layer of wood—have some provision made for getting rid of this outer bark.

Not only have the trees their own particular kind of bark, but they have also separate ways of disposing their trunks and branches. When in the forest with numerous other species, they must struggle up as best they can to the light and air over head, but when left to themselves with no competitors near, they assume their own peculiar shapes. Notice how the elm grows upward in a graceful fan shaped or plume like head, while the lombardy poplar with branches growing in the same general direction resembles nothing so much as a worn out broom, with each separate twig possessed with a desire to point as near the meridian as possible. How this stiff and awkward poplar ever came to be cultivated in dooryards when other trees were to be had, seems a mystery. We are inclined to wonder what kind of minds are possessed by the people who love such things. Doubtless they are the same people who originate those botanical monstrosities the "weeping" trees in which the twigs show an abnormal tendency to grow earthward instead of up and out into free air and sunshine. In passing it may be well to correct an impression which prevails in some quarters in regard to these same weeping trees. They are not produced by grafting the top of a tree upside down as many people suppose.

The white pine towers upwards to heights far beyond the poplar, but how neatly it escapes the ungainly by a system of regular and horizontal branching. And the hemlock, while not so regularly branching as the pine, what a picture of rugged grandeur a well grown specimen of it presents! The chestnut tree when standing alone in a field forms a broad pyramidal head as do many of the oaks and maples, but it is seldom that the hickory will do so.

How two trees growing side by side can suck up from the earth and take in from the air, the materials for such diversified substances as they may produce will always be a fruitful subject for speculation. One will be too soft for any practical purpose; the other may be as hard as metal. Nor do the trees lavish all their beauty on the outside; there are many beautiful colors hidden away beneath the dingy bark, from the dark rich browns of the butternut and walnut to the pure white of their relatives the hickories. The wood of the cherry and sweet birch is the color of mahogany and scarcely to be distinguished from it either by color or hardness. The wood of some oaks is red, while that of the sumac and locust are mixtures of green, yellow and brown. If we extend our inquiries to the tropics even more varied colorings surprise us.

In almost any locality, there are from twenty-five to fifty different kinds of trees. Commonest among these are likely to be the elms, maples and oaks and the casual observer is usually able to recognize these at least. Still it is not always the commonest species that are best known. The writer recalls a service-berry tree that stood near the entrance of a public park loaded with its dark red fruit in shape something like a tiny apple or good sized huckleberry. Of the thousands who visited the park and passed the tree with its palatable burden, none appeared to consider the fruit worth tasting. And so it happened that his own party was able to harvest somewhat more than a quart of the sweet and juicy berries. The service berry is also known as the June berry, and shad-bush. Under the latter name it is familiar to nearly everyone in the regions where it grows, for its cloud of conspicuous white blossoms lights up the vernal woods before the leaves have opened and fairly forces the species on our attention. But by June the blossoms have been forgotten and the fruit passes unrecognized. The name of shad-bush was given the tree because it was supposed to bloom at the time when the shad appeared in the rivers.

The bass-wood, called linden by the Germans, is another conspicuous member of our woodlands, forming a tall straight trunk of considerable girth. It is also known as white-wood, lime tree, and bee-tree. Its wood is soft and light and was once considered of little use, so much so, in fact, that it has passed into a proverb, "a bass-wood boy," being considered synonymous with a good-for-nothing youngster. Basswood however, has its uses. The wood is now frequently used for panelling and the tough inner bark called bass or bast is made into coarse mats, rope, and twine. From the bloom of the basswood the bees extract a great deal of honey, equal in the opinion of many, to the best clover honey. The fruit of basswood is a hard round nut the size of a pea, which is borne in small clusters on a winged peduncle.

In most localities when one speaks of sassafras the image of a low bush or shrub usually comes to mind. It will perhaps surprise some to learn that this plant often grows to be a foot and a half in diameter. The aromatic pungent bark of the root is known to every boy. In winter the sassafras may be identified by the green bark of the twigs, and in summer it is easily recognized by the leaves. These latter have the curious habit of bearing a single lobe on one side, so that to say the leaf is mitten shaped exactly expresses it. Sometimes, however, there is an additional thumb-like lobe on the other side and occasionally the leaf is without lobes at all.

There is one tree in many localities which deserves more attention from poets and artists than it receives. This is the sour gum, black gum, pepperidge or tupelo. It is one of the most rugged and picturesque trees in any landscape. For gnarled and twisted branches it has no equal. It is an apparent impossibility to cut a straight stick a yard in length from it. This obliquity extends to the very fibres of the tree which are crossed and interlaced in such a manner as to fairly defy one to split it. Holmes' remarks on the logs from the "Settler's ellum" may be quoted in regard to this species.

> "Never an axe had seem their chips.
> The wedges flew from between their lips,
> Their blunt ends frizzled like celery tips."

And this is doubtless why it is called gum, gum being another name for rubber. But the birds love the tree, for its fruit and who ever heard of an opossum up anything but a gum tree except perhaps, a persimmon. The fruit is a drupe like the plum but smaller and like the persimmon not edible until frosted. Early in Autumn the leaves of this tree turn deep crimson.

A conspicuous tree in regions where it grows is the larch, best known by its Indian names of tamarack and hackmetack. It is one of the few cone-bearing trees that do not retain their leaves in winter. It loves best the swamps and bogs where it often takes almost complete possession. Longfellow has referred to the use of its roots by the Indians for sewing up the seams in bark canoes. The wood is hard, strong and durable.

One of the leading orders of the vegetable world is the legume or pea family, but though it is represented in our climate by many plants such as the bean, pea, and clover, the locusts are practically the only ones that become trees. Everybody knows the locust blossoms and the bees knew them before we did. The wood of this species is the most durable for out-of-door purposes of all North American trees. The writer knows of a fence post that is reputed to have stood in the ground for more than seventy years. It still holds up its section of fence, but has literally grown gray in the service.

In a list of remarkable trees we must not forget the tulip tree, known also as white wood and yellow poplar. The majority of our forest trees bear only inconspicuous flowrs, but this makes up the deficiencies of other species by producing great blossoms often four inches across. These are greenish yellow marked within with orange. The leaves resemble the leaves of the red maple with the central lobe cut squarely off. The wood is light and soft. It warps quickly but is easily worked and is much used in interior finishing under the name of whitewood. This wood formed part of the "one hoss shay."

> "The panels of white wood that cuts like cheese
> But lasts like iron for things like these."

The fruit looks something like a young cucumber and the tree is sometimes wrongly called cucumber tree.

The aspens which are quick to spring up in wet or burned-over places are related to the cottonwoods. They may be distinguished by their light green almost vegetative bark. The wood is very soft and has no use in the arts except in the manufacture of a coarse kind of paper. The phrase "trembling like an aspen" really expresses something for aspens have the most tremulous of leaves. This is due to the fact that the leaf stem is flattened sidewise causing the leaf to sway with every breath of air. That the aspen is durable when protected, is hinted at in the couplet applied to the species which runs:

"Though heart of oak be ne'er so stout,
Keep me dry and I'll see him out."

TREES THAT YIELD BUTTER.

BUTTER, as the term (from a Greek word meaning "ox-cheese") implies, was originally a name for a product obtained from the milk of the cow, and afterward, by extension, for a like substance obtained from the milk of other animals such as the ewe and the goat. By a further extension, the name has been applied to certain fixed vegetable oils, the melting point, consistency and aspect of which resemble butter of animal origin, such as "butter of cocoa," a concrete oil of a sweet and agreeable taste obtained from the kernels of the fruit of *Theobroma cacao* or "chocolatenut tree;" "butter of Bambuk," an oil obtained from a species of almond in Senegal, and used medicinally; and "butter of nutmegs" or "butter of mace," a sebaceous substance expressed in the East Indies from the arillus of the fruit of *Myristica moschata.*

To the plants yielding such oils has been applied the name of "butter-trees," and to the oils themselves the term "vegetable butter." The "butter-tree" of Nepal is the *Basia butyracea,* the seeds of which yield by pressure a semi-solid oil, which thickens and becomes of the consistency of lard. It is called "phoolma," "chorce," or "vegetable butter," and is used for culinary purposes, and, by the natives of rank, for anointing the body. The seed of *Bassia latifolia,* the "mahwa-tree" of Bengal, yield a greenish-white oil which is of the consistency of butter, and which is used as such by the poorer classes. From the flowers of the tree is distilled a spirit resembling whisky, which the natives like better, and consume in large quantities. Another species of the same genus, *B. longifolia,* the illupie-tree, affords an oil similar to that obtained from the two preceding trees, and which is used by the Ceylonese for culinary purposes. The "butter-tree" of Africa, the seeds of which produce the "galam butter" or "shea butter" mentioned by Mungo Park in his travels, is a species of the same genus, *B. Parkii.* The fruit when ripe is of the size of a peach, and, after being dried in the sun, is pounded in a mortar until reduced to flour. It is then mixed with water and boiled for a short time, when greasy particles become detached and rise to the surface, whence they are then skimmed. When cold the oil is of the consistency of butter and will keep fresh for two years. It has an agreeable taste, is used as food, and is an article of considerable trade with the natives of western Africa. The "butter and tallow tree" of Sierra Leone and other parts of west tropical Africa is *Pentadesma butyracea,* the "kamoot tree," or "kanya tree." From the seeds of this, the natives extract an oil called "kanya butter," which is used by them for cooking. The butter is extracted by drying and parching the seeds, then pounding and boiling them, and skimming off the supernatant oil. A yellow greasy juice is given out freely when the fruit is cut or opened. The oil has a terebenthene flavor, and is therefore not relished by the English settlers. It is sold as butter in the markets of Freetown.

Garcinia pictoria, a tree abundant in Mysore and the western coast jungles, yields the pigment gamboge, but is more important for the oil obtained from the fruit and called "gamboge butter." An allied species, *G. purpurea,* furnishes a similar oil called "cocum butter." These oil butters are obtained by pounding the seeds, boiling them, and skimming off the floating grease. They are used as substitutes for butter as well as oil for lamps.

Combretum butyraceum, called by the Kaffirs "chignite," a climbing shrub or tree of the Myrobalan family, and a native of southeastern Africa, yields (whether from the fruit or bark is not known) a white, butter-like aromatic substance which is taken to Mozambique as an article of commerce.

The *Elacis guineensis,* the palm which yields the palm oil of commerce, is a native of tropical western Africa. The part yielding the oil is the outer fleshy coating of the fruit, but the seed, which is inclosed in a hard shell, likewise affords an oil. Commercial palm oil is of about the consistency of butter, of a bright orange-red color, and of a pleasant violet-like odor when fresh. In Europe and America it is largely used for making soap, but in Africa it is eaten as butter.

"Cocoa butter" is a fatty concrete substance obtained by boiling and pressing the white kernel of the nut (albumen) of the "cocoa-nut palm," *Cocus nucifera.* The oil is liquid at the ordinary temperature in tropical countries, and, while fresh, is used in cooking; but in this country it is semi-solid and generally has a somewhat rancid smell and taste. The seeds of an allied species, *C. butyracea,* a native of New Grenada, likewise yield a butter in the form of a semi-solid oil. Several related species give analogous products that bear the name of "copral" when the nuts, broken and dried in the sun, are sent from central Africa, through Zanzibar. This contains 80 per cent of oil which, when extracted, is used in the manufacture of soap. "Butter of canara" is an oil obtained from the fruits of *Vateria indica,* a tree indigenous to the Malabar coast. It is a vegetable butter of solid consistence, beautifully white, and requires a higher temperature to melt it than animal tallow. Candles made from it burn with a clear light, and produce an agreeable fragrance.

The "japuru butter" tree, *Erisma Japuru,* of Brazil, is a noble tree growing on the banks of the Upper Rio Negro and Uaupes, and which bears red fruits of which the kernels are pleasant eating, both raw and boiled. Butter is prepared from these as follows: After having been boiled from morning till night, they are well covered up, and put into baskets in running water, where they are allowed to remain two or three weeks. When, at the end of this period, they are spread out, they emit a disagreeable stercoraceous odor. They are then beaten in a mortar until they have the appearance and consistence of pale butter. To receive this, a large cylindrical basket is made of strips of the trunk of a palm and lined with leaves. The basket is placed on a stage over a fire where it is usual to put things that need to be kept dry, and there the butter will keep good for two or three years. "Jupuru butter" is eaten with fish and game, being melted in the gravy along with the fruits of various species of *Capsicum,* which constitute an essential ingredient in the *mohlo* at every Brazilian table, whether the guests be red of white. People who can endure the vile smell, which is never lost, find the butter very savory.

The fruit of *Persea gratissima,* the "avocado" or "alligator pear" of the English, or "palta" of the Peruvians, contains a large amount of a firm, unctuous, oily pulp having exactly the taste and appearance of yellow butter, and is frequently called by the English residents of the West Indies "midshipman's butter" or "subaltern's butter." It is usually eaten with spice and lime juice or pepper and salt. An abundance of oil useful for illuminating purposes and for soap making is obtained from the pulp by expression.

What is called by the French "beurre de mango," and by the English "mango butter," is a fatty matter obtained from a species of Mangifera of the order Anacardianceæ.

Finally, a substitute for butter is afforded by the yellowish fatty pulp contained in the edible fruit of the "mucuja palm," a tree forty feet in height growing on the mainland of the Lower Amazons. This oily pulp, which is eaten, is sold in the markets throughout Brazil.—*W. R. Gerard in Scientific American.*

NOTE AND COMMENT

WANTED.—Short notes of interest to the general botanist are always in demand for this department. Our readers are invited to make this the place of publication for their shorter botanical items. The magazine is issued as soon as possible after the 15th of February, May, August and November.

CHESTNUT BARK DISEASE.—It is probably not new to most of our readers that a very serious bark disease theatens the chestnut trees of Eastern America. Since its discovery, eight years ago, it has caused a loss of nearly twenty-five million dollars. The disease is a fungus and is spread by spores so small that singly they are invisible to the unaided eye, but their power for harm is in no way dependent upon their size. When the disease attacks a healthy tree it is only a matter of a few months before it succumbs. Great efforts are being made to stop the spread of the disease, thus far without much success. It was first discovered in the vicinity of New York city and already has spread to half a dozen near-by states. It is estimated that if the disease finally succeeds in exterminating all our chestnut trees, it will cause a loss of more than three hundred million dollars.

BORING LARVAE.—The botanist rarely pays much attention to the insects that feed upon his specimens, except perhaps to execrate them when they injure the plants he wants for himself, but there are several problems connected with insect life that will probably not be settled until some one with a knowledge of botany takes hold. This is true in the case of the boring larvae which become moths belonging to a group rather widely distributed in the United States. Many of the moths are known, but the larvae have never been seen, and it is a matter of conjecture as to just where they pass their early days. One species, *Papaipema rutila,* the type of which is in the British Museum, was collected somewhere in Illinois in 1852 and has never been seen since. Its larvae may have fed on some wild plant that has since become rare, and in this way become practically extinct since a large number of the borers are restricted to a single species of food plant and die when its food plant disappears. Dr. Henry Bird of Rye, N. Y., who is making a specialty of these insects writes as follows regarding the plants upon which they feed. "The list of foodplants run from Composites to Cryptogams, so there is no particular family to count on, it is simply a case of searching. As you may gather, particular floras limit the zone of certain species of these moths; in the stems and roots of the salt-water goldenrod (*Solidago sempervirens*), a certain species bores in its larval existance and is confined in its flight as a moth to the fringe of Atlantic seaboard where this plant occurs. Species boring ironweed follow its distribution; several of the sunflowers serve more widely distributed species. *Podophyllum peltatum* and *Rudbekia laciniata* are foodplants with species west of the Alleghanes but have not been found infested in the East. *Sarracenia purpurea* and *S. Drummondii* afford another range from Ontario to the Gulf, where bog conditions prevail. Among the ferns *Onoclea sensibilis* and *Pteris aquilina* support two primitive types over an extended area; *Cirsium occidentale* is preferred by a Pacific coast species I have just described. *Aquilegia, Eupatorium, Thalictrum, Collinsonia, Ambrosia, Arctium, Heracleum, Zizia, Humulus,* and many more furnish other species with sustenance." As soon as the larvae hatch they begin to bore in stems or roots. Some change to chrysalids within their galleries and these have the instinct to make a door to the outer world through which the moth may escape. In all cases the borers make a small ventilating hole and through this the castings are ejected. Dr. Bird is anxious to secure specimens of boring larvae from the middle west in the hope that he may eventually rediscover the long lost *rutila*. It is assumed that the best time of year to search for the larvae is during the month of July, but it is well to be on the lookout at other times especially as all the moths are not known yet and one has some chance of discovering an entirely new species. Larvae can be sent to Dr. Bird in a section of the plant in which they bore, enclosed in a tin box. When you discover boring larvae of any kind, send them to Dr. Bird.

BEES AND FLOWER COLOR.—In the old days when everybody was intent on discovering additional proofs in support of the Darwinian theory, it was shown how admirably bees and flowers were adapted to each other to secure cross pollination, by the assumed fact that when the bees set out on their morning expeditions they picked out a color that harmonized with their state of mind and obstinately refused to visit flowers of any other hue during the day. All of which would be, as Horace Greeley used to say, "interesting if true." As a matter of fact, the bee, though supposed to stick to her particular bee line of blossoms doesn't do anything of the kind as anyone who will visit a garden of multi-colored flowers may easily discover for himself. If bees are found to be working on flowers of a single color, there are other reasons for it than the hue of the blossoms. If, for instance, a plant with yellow flowers happens to be producing abundant nectar, the flowers are likely to be well patronized by the insects, but when no species with marked nectar flow is blooming the bees visit any likely flower within range. Nor is the bee's reputation for favoring blue and purple flowers sustained in the flower garden, however much it may appear to be when bits of colored paper smeared with honey are substituted for flowers. The bees visit the blossoms having the most nectar. When one of these insects visits a flower and finds plenty of nectar, it is likely to continue its visits to such flowers, and it is doubtless in this way that the bee's reputation for adhering to a single kind of flower while gathering nectar, has been earned. The bee is a saving creature and wastes no more time in flight than necessary; therefore, when it finds flowers of one kind near together it visits them all in preference to searching for fresh fields. In this way the advantage to plants of producing flowers in groups or clusters is explained. It is said that all the highest types of flowers are in clusters. Doubtless this method of bearing their blossoms did much to facilitate their rise in the plant world, simply because it gave a slightly better chance of pollination.

ARCTIUM MINUS LACINIATUM.—Since the mention of this curious form of the burdock in this magazine, Dr. Henri Hus of the University of Michigan has been investigating its history with the result that it appears to have occurred several times in the United States. The earliest record is that of Darlington, author of "Flora Cestrica" who found it at West Chester, Pa., in 1858. J. W. Robbins collected it at New Bedford, Mass. in 1890 and A. E. Ricksecker found specimens at Elyria, Ohio in 1894. The form has also been collected in Europe, but appears to be very rare in herbaria, only one specimen having been located up to the present. In recent years the form has been found several times in the north central states. It has been found at Joliet every year since 1909. Further notes of its occurrence in other localities are desired. It is possible that in this plant we are dealing with a form that has arisen from the common burdock by mutation and now shows a tendency to become more abundant. If so, it has all the interest of the evening primrose species made famous by DeVries. An extended account of this form and many others is given by Dr. Hus in *American Naturalist* for November 1911.

Fall of the Leaf.—Nearly everybody seems to think that the fall of the leaf is due to frost, forgetting in their reasoning that many leaves fall before frost has touched them. Moreover, if the leaf fall were due to frost we would expect the plants of warm climates to retain their leaves indefinitely which is not the case. The most potent cause of the deciduous condition in plants is undoubtedly drouth, but there are indications that the casting of the leaves may also be due to more deeply underlying physiological conditions. These indications show most clearly in the behavior of tropical plants where all kinds of variations in leaf fall may be observed. Some species cast their leaves one by one throughout the year, but the majority have a definite foliar periodicity. The time at which the leaves are cast, however, differs with the species and occasionally with the individuals, or even with different parts of the same individual. In some woody plants one may find specimens in which some branches are clothed with new leaves, others from which the leaves are falling and still others which are leafless. Individuals of the same species of different ages may behave differently in this matter.

The Fuller's Teasel.—Without doubt, the name of fuller's teasel (*Dipsacus fullonum*) is much more familiar to botanists than the thing itself. Even the "common" teasel (*Dipsacus sylvestris*) appears to belie its name in certain regions for the latest edition of "Gray's Manual" makes it "rather rare." Along the main lines of travel in the Northern States, however, the latter species is often encountered, but the fuller's teasel is certainly among the rarities. It may be doubted whether one botanist in fifty has ever seen it growing. In view of this fact, it may be surprising to many to learn that this plant is cultivated in some parts of the United States in quantity, and that in 1910 nearly $7000 worth were exported to Great Britain. That country uses some $75000 worth in the course of a year. The fuller's teasel gets its name from its use in fulling cloth, the sharp recurved and elastic bracts of the flower-head being very useful in raising a nap on woolen goods. The heads are fixed on a rapidly revolving wheel or cylinder and the cloth passed over it in such a way that the fibers are caught and shredded out. It is said that the inventive genius of man has never devised an implement for this work that could compare with this one of Nature's own making. Most of the American teasels come from a small region in Onondaga county, New York, where the industry has been carried on for more than seventy years. Though there seems to be no immediate danger that the demand for teasels will cease, there is also little inducement for others to embark in their cultivation because of the limited use. Since the teasel is a biennial two years are required for one crop and considerable hand labor is necessary especially in harvesting and sorting. So nicely must the heads be arranged for various classes of work, that they are often sorted into seventy different sizes. An average crop will give 100,000 heads to the acre which bring in market from fifty cents to two dollars a thousand.

Automobile Tires from Potatoes.—Few botanists ever acquire sufficient funds to put them in the class of those who are annoyed by "tire trouble" and so are not directly interested in the synthesis of rubber, but as plant students they may take an accademic interest in the matter. Many attempts have been made to make artificial rubber, but only recently has the task been accomplished. According to *Scientific American* two German chemists have recently produced rubber equal in all respects to natural rubber, starting with such unpromising objects as potatoes. In the last step of producing rubber synthetically, a hydrocarbon called isoprene is exposed to metallic sodium and rubber results. All that remains, then, is to find a cheap source of isoprene. This can be made from starch of any kind, potate starch being as useful as any. Taking this starch it is first fermented to form fusel oil and acetone and from these the isoprene is produced. It thus appears that the humble potato may support life in an entirely new way. Last year the world used nearly seventy-five thousand tons of natural rubber and the demand is steadily increasing. In May 1910 rubber brought more than $3.00 a pound, but this is an unusual price. The British, who have always been fond of speculations in rubber, haae founded a company with $2,500,000 capital to manufacture the new artificial rubber. It is said, however, that notwithstanding the fact that the artificial product seems to be idenical with the natural, it is not likely to soon crowd it in the market. Only a small amount of isoprene can be made from a given bulk of potatoes and the cost of producing this is still very great.

Poisonous Moonseed.—The poisonous nature of the moonseed (*Menispermum canadense*) has again been forcibly brought to notice through the death of a small boy at Lemont, Ill. from eating a few of the fruits. The boy who was seven years old, found what he supposed were wild grapes as he was returning from school. He ate three of the fruits and in the course of a few hours became violently ill. In spite of medical attention he died the next day. Many dealers in decorative plants offer the moonseed for sale and it appears to be extensively planted for covering arbors and the like, its poisonous nature apparently not being suspected. The fruits are large, deep purplish-black and quite attractive in appearance. When grown about dwellings one ignorant of its qualities might easily be tempted to try it with disastrous results. The vine, however, is a very decorative one with large, glossy angular leaves that are free from the vermin that attack many climbing plants. Fortunately the species is dioecious, that is the stamens and pistils are on separate plants. By using the staminate form one may have the plant without danger of poisoning, but he ought to make sure that it is really staminate.

SCHOOL BOTANY

Stomata Easily Seen.—The stomata or breathing pores of plants vary greatly in size, but it is seldom that they become large enough to be visible to the unaided eye. To be sure, the tiny specks seen in the bark of most young twigs are essentially like stomata in function and similar to them in origin though they are unlike enough in structure to be given a different name and are known as lenticels. The true stomata are very much smaller and most plant students are likely to consider them strictly microscopical in size. However, on the underside of the leaf of the madonna lily (*Lilium candidum*) a common white lily of the gardens, the stomata are visible without a lens. Many other plants have stomata visible with a simple lens and among these may be mentioned several of the monocots such as narcissus, canna, iris, and yucca. The dicots in general seem to have much smaller and more numerous stomata. Some single leaves may have several million stomata on the under surface.

Leaf Skeletons.—Another method of making leaf skeletons having some advantages over those given in the last number of this magazine is found in Payne's "Manual of Experimental Botany" recently issued by the American Book Company. In this it is advised to select leaves with a rather firm frame-work. These are to be boiled for fifteen minutes in water to which a heaping tablespoonful of any cleaning powder is added. After boiling place in a dish of clear water to remove the cleaning powder. The leaves may then be placed one at a time on a dinner plate and water allowed to drip on them. This spreads them out on the plate and washes the leaf pulp out of them. At this point the veins may be bleached with a bleaching powder or colored with various aniline dyes. After the veins have been cleared of pulp they may be dried between blotters and then mounted either by placing between two sheets of glass and binding with passepartout paper or by mounting on a sheet of contrasting cardboard and covering with glass. Those mounted between two sheets of glass may be used with the stereopticon.

METABOLIC WATER.—The starches cellulose and sugars of plants belong to a class of foods known as carbohydrates because they consist of carbon hydrogen and oxygen. Such foods are formed by the union of carbon derived from the carbon-dioxide in the air with soil water taken up by the roots. When they are oxidized as in the process of respiration occurring in both animals and plants, the carbon is again set free in carbon-dioxide and the water remains in the organism. This water is called metabolic water. The addition of water to the plant in this way, or in dehydration, as when water is withdrawn from one substance in changing it to another, is now regarded as being of much more importance than is commonly supposed. The complete oxidation of starch or cellulose leaves more than half the original weight of water while the dehydration of glucose when changed to starch sets free ten percent of water. The existence of metabolic water explains how the clothes moth and bean weevil which never have a chance to get a drink are, nevertheless, fat and juicy. Their moisture comes from the oxidizing of the substances upon which they feed.

EDITORIAL

The next number of this magazine will have so many changes and improvements made in it that even its best friends will hardly recognize it. To begin with, a much better grade of paper will be used and a large number of fine illustrations will add interest to the text. A department of ornamental gardening will also be included and present to our readers the best methods of planting and caring for our decorative plants, with observations on their use and value. The new features contemplated will in no wise crowd the matter at present appearing in the magazine for we shall add 25% more pages to take care of this. We are enabled to make these improvements by reason of the increased circulation which the combining of *The Fern Bulletin* with this magazine will give us. *The Fern Bulletin* is the third oldest botanical publication in the United States and for twenty years has had an uninterrupted and successful existence. The editor, however, finds conducting two magazines in addition to much other work, a little too strenuous hence the combination. Hereafter our readers will find much that concerns ferns in the magazine, and since these highly decorative and attractive plants are always of interest, our readers will no doubt, welcome the combination. Finally, we contemplate paying for manuscript in future. This ought to ensure the highest grade of matter for publication and readers will benefit accordingly. The price of the magazine will remain unchanged to all present subscribers. To new subscribers it will be advanced. We feel sure that the next volume will far surpass any that we have issued and we trust that every reader will make sure of a copy by renewing promptly.

A few years ago, the Post Office Department ruled that magazines published quarterly could send only one copy to readers after their subscriptions expired. In consequence we were obliged to cut off a large list of subscribers who were accustomed to receive the magazine and pay during the year when most convenient. Many of these became highly indignant at this action which appeared to carry the imputation that we feared to trust them, and some have never gotten over it. A subsequent ruling of the Department allows us to mail the magazine one year before separating those in arrears from the mailing list. There has consequently been built up in this office, a list of supporters of the magazine, who might be characterized as perennial subscribers. Their subscriptions are not annual, but continue to run until ordered stopped, and are paid for during each year when most convenient. Such subscribers are never worried about the loss of one or more numbers between the expiration and renewal of subscriptions and do not have to renew immediately no matter how inconvenient it may be, to avoid being removed from the mailing list. We are desirous of increasing the number of such subscribers and enclose a blank with this number for the convenience of those who care to transfer to the permanent list. *No person will be transferred to this list unless we have express orders to this effect. All other subscriptions are discontinued as soon as they expire.*

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Referring to the recent demise of a magazine devoted to flowers, *Horticulture* is of the opinion that the general public has been having a surfeit of garden and country life literature and observes that "what is needed now, is not more journals but better ones and a public tuned up to appreciate them." There is much sound sense in this conclusion. Most of the periodicals devoted to gardening have got into such a rut that one can safely say in advance what the next number will contain. In September and October the contents will run largely to bulbs. In February and March to hotbeds and seedsowing, in later months to annuals and bedding plants. This would all be well enough if any effort was made to vary the matter relating to these subjects, but the same old tulips and hyacinths and narcissi form the subject of the theme in autumn, while the education of the festive cabbage, the toothsome radish and the succulent potato is certain to have the front pages and top of column as regularly as the spring comes round. It is hard to decide whether this is the fault of the publisher or of his circle of readers. One may, indeed, question whether a magazine devoted to the unusual flowers and vegetables would be as successful as one that constantly harps on the way to cultivate the commoner ones. Certainly the general public rarely has a taste for anything out of the ordinary in gardening. Its predilections run largely to lilacs. "syringas," bridal wreath and roses in the line of shrubs, and peonies, bleeding hearts, phlox, and the common day lily among perennials. Seldom does it get beyond the common annuals—morning glories, asters, pansies and petunias. Here and there on large estates where the planting has been done by the landscape gardener we find the rarer shrubs and other perennials, but elsewhere the nature of the planting indicates that we are still far from ideal conditions. The great mass of the people still need to be shown that there are better and more beautiful plants than the few with which they are familiar. They need to know that there is more than one iris or day lily, that the Canterbury bells have finer and more permanent relatives, that in general perennials are far superior to annuals and so on. But how are they going to find out these things if the gardening magazines persistently stick to their tulips and cabbages?

BOOKS AND WRITERS.

Prof. E. F. Andrews, author of "Botany All the Year Round" has brought out a new book in similar style with the title "A Practical Course in Botany." This follows the sequence of studies generally in use beginning with seeds and seedlings, discussing the various plant organs and ending with a short survey of the spore-plants. Throughout the book numerous references to agriculture and economics connect the work with the environment of the pupil. This is especially noticeable in the "practical questions" that follow each chapter. In the opinion of the reviewer, however, it is a mistake to combine the laboratory manual and the text-book in a single volume. In physics or chemistry it may be allowable to discuss the theoretical side of a problem and follow it with laboratory demonstrations, but in botany it is pretty certain that the experiments should come first, and be experiments to discover some function or property and not demonstrations to "show" or "prove" anything. The new book may also be had bound with "A Brief Flora of the United States," by Dr. W. N. Geddes. This is modelled rather closely after the well-known flora in Wood's "Class book of Botany" and includes all the common flowering plants exclusive of a few difficult groups such as grasses and sedges The families follow a sequence now in disuse but it is understood a revised flora is being prepared. The book is issued by the American Book Company.

Dr. H. S. Pepoon, the senior author of "Studies in Plant Life," a book that has been used for many years as a laboratory manual in botany by the high schools of Chicago and elsewhere, has recently revised this work and issued it under the title of "Representative Plants." It is designed to cover a year's work in botany and begins, as such works should, with the structure of well known plants and ends with the less familiar spore plants and some consideration of their evolution. The new book differs from the old principally in the method of approach, which is now mainly inductive, and in the constant association of the work with industrial commercial and agricultural processes all of which adds to its value for school use. There is noted, however, a tendency to refer the students to books in a search for much information that, while possibly interesting or entertaining, is not worth while in comparison with what might be learned at first hand in the laboratory in the time necessary to run down second-hand information in books. In the opinion of the reviewer too much space is given to a study of flowers and too great emphasis placed upon the characteristics of the various plant families. Moreover some of the species suggested for study, such as the milkweeds, are rarely in flower during the school year. There are various loose expressions here and there in the book which we have no doubt will be corrected in later editions. References to the "spicy" juice of crucifers, "cacti plants" the unusual spelling of nightshade, the placing of the gladiolus corm with bulbs, the spelling of some generic names without capitals and the statement that plums and cherries are usually multiplied by grafting may be cited as instances. Nor is the inference that ordinary trees will produce logs in twelve years that will square twelve inches likely to be realized. In our opinion, also, the study of the pine seed should be relegated to the special study of gymnosperms since in the study of stems, leaves and flowers the pine is scarcely mentioned. The book, however, is a vast improvement over the original work and the small blemishes detected are not sufficient to impair the usefulness of this excellent presentation of botany for the high school. The book is a 12mo. of 160 pages and costs 60 cents. It is issued by Ginn & Co., Boston.

The appearance of the "Spring Flora of the Intermountain States" by Aven Nelson directs the attention anew to the fact that in many parts of our country the identification of plants and the making of herbaria is still a considerable part of the school course in botany. The new book is intended to include only the plants of the Rock Mountain region that bloom before the close of the spring term and has a decided resemblance to the larger volume on the flora of the Rock mountains issued by Nelson and Coulter. In a book of this nature, with the implied purpose of making the wild plants familiar to the general public, we are inclined to question whether it could not with advantage have been made a bit less technical. Certainly one who knows nothing of the jargon of the systematist will find picking plants out by means of this volume, a difficult matter. Under the guidance of a botanical teacher, however, the book ought to be of wide usefulness. The fact that only spring flowers are included rather adds to its value since the beginner is not confused by a multitude of species that bloom at other seasons. Considering the title we wonder why "intermountain" was selected in place of the more appropriate intermontane. The book is issued by Ginn & Co., at 75 cents.

Another new book attacking botany from the experimental side is Frank Owen Payne's "Manual of Experimental Botany." The volume is practically all experiment and each subject is taken up under the rather formal heads of object, apparatus, method, result and conclusion. As might be expected, many of these experiments are likely to be considered too insignificant to be worth while performing but the book is valuable for the wide range of topics given and especially for the bearing of many of them on gardening and nature-study. The teacher may be cautioned, however, against assuming that all the experiments prove what they set out to prove. The inference on page 137 that a girdled tree dies because the flow of sap upward it stopped is important of true. So is the assertion that the corm of Indian turnip is poisonous. Several other slight inaccuracies of statement may be found but they are not such as to seriously interfere with the purpose of the book. Like most works of this nature it may be depended upon to offer stimulating material upon which the intelligent teacher can draw for illustrating any particular subject. It is published by the American Book Company, New York.

Plants for Cold Climates.—With most plants, hardiness is only a relative term. A few arctic plants may be called truly hardy, but all the rest are only comparatively so. In certain regions, or under certain favorable conditions they may survive the winter without protection, but each species has its own limits beyond which it is not hardy, though one may endure a season of cold that would kill another. Dwellers in our northern tier of states find the matter of hardiness in garden plants of much more importance than those further south consider it. In Pennsylvania, Ohio and Illinois most of the commonly cultivated perennials prove hardy, farther north, one after another give up the battle. Such conditions make all attempts to acclimatize our plants in more northern regions very interesting. At Devils Lake, North Dakota, is a nursery said to be the most northern in America and one can glean from the catalogue of plants offered for sale, some idea of the hostile climate there encountered. Of course the locusts, magnolias, coffee tree, ailanthus and the like are absent. The willows, black walnut, box elder, elm, hop tree and poplars do well while the pea tree (*Caragana arborescens*) and Russian olive (*Eleagnus angustifolia*) are added to the list. Among shrubs we note the June berry Shepherdia argentea, lilac, ninebark, snowberry, and several species of spiraea and honeysuckle. The day lilies perennial poppy, iris, peony, bleeding heart, larkspur and columbines are all hardy in that region. Experiments are in progress to test the hardiness of other plants as well as to introduce the showy native flowers into cultivation.