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OUTSIDE THE GARDEN.

SOME RELATIONS OF BOTANY TO HORTICULTURE--THE BOTANIST IS WILLING TO CLIMB THE GARDEN FENCE.

PROFESSOR TRACY, in 1877, made the statement before the Michigan State Horticultural Society, that horticulture had advanced but little in the past 150 years, except in two directions. The greatest progress had been made by botanists, who had by systematic efforts originated new varieties. Progress nearly as great has been made by the entomologist in his systematic warfare against insect enemies. Probably the statement is as true in 1890 as it was thirteen years ago. We should certainly, also, at this time, credit the botanist with many investigations of the life history of the lower forms of plant life, which are injurious to cultivated plants, and in discovering remedies for many of those most destructive.

Botany, as taught to-day by the best teachers, is emphatically a science in which the student is sent directly to nature for his facts. In this way he becomes an accurately trained and reliable observer. He applies numerous questions to his plants, by observation, trying many experiments, and in studying their behavior; in this manner, the student cultivates his judgement and learns to draw correct conclusions.

Well grounded in systematic botany, he is likely to avoid falling into numerous errors so often made by persons who learn horticulture as a mere trade. This systematic side of botany is indispensable to one in distinguishing and naming plants in cultivation, and in observing their affinities.

Geographical botany may teach of the soil and climate in which a certain plant thrives, and how to treat it when carried to a new country. Here, however, experience, experiment and the judgement are all valuable aids. Plants are not always found in a wild state where they will thrive best. This is true of many of our weeds, and of many plants cultivated for various purposes.

Who will point out the relationship of plants and find suitable stocks on which to "work" our cultivated shrubs and trees? The botanist. And the botanist will know better than to attempt a union of scions of chestnut on stock of horse-chestnut—something actually attempted by a horticulturist of my acquaintance. The resemblance of the fruit of the one to the seeds of the other deceived him into thinking the union practicable.

No one, excepting a systematic botanist, would be competent to visit foreign countries to select new plants worthy of cultivation. Systematic botany is not only essential in identifying, describing and classifying plants, but it is well equipped with all the necessary paraphernalia in the way of technical terms and methods to perform the task of describing in an exact manner, all "artificial" forms that have been bred or selected. The time has already come for more accurate and complete descriptions of varieties and races of vegetables than have yet been written.

Cultivated varieties of strawberries are usually described by the fruit, with a few references to the leaves and possibly to the length of the stems. The botanist who had never compared the runners, the inflorescence and the flowers in detail, will be surprised to find that in them we have very marked differences which could well be illustrated and described. Fifteen years ago or more, I discovered this fact and described some varieties, though the descriptions were never published. I have described 150 varieties of apples by a careful examination of inflorescence and flowers, in most cases making drawings to equal scales. There are now so many

varieties of cultivated fruits, that we need to make use of all the good characters that can be found to aid in making complete characterizations.* I have many times made the statement that no variety of fruit can now be called well described, unless the peculiarities of inflorescence and flowers are considered in connection with every other characteristic feature.

A knowledge of systematic botany will enable a teacher or the worker in horticulture to group his information, thus greatly aiding the memory and shortening the process of giving or receiving instruction. He learns that plants known as cucurbitaceæ have monœcious flowers, which must be pollinated by insects, wind or by hand; that they love heat, are sensitive to frost, that similar insects prey upon many of them. The garden plants known as cruciferæ have many peculiarities in common, well understood by botanists, such as a pungent, watery juice, the seeds starting early, the young plants enduring some frost, and in many cases the same insects trouble numerous species. He learns that seeds of the umbelliferæ have a low vitality and are slow to germinate. These are but a few examples out of many which could be given.

The botanist understands why some varieties of strawberries, apples and other fruits frequently fail to "set fruit," and in some instances he can prescribe a remedy. He has learned to see that the visits of insects to the flowers aid in ensuring a larger crop of fruit, as he knows that the showy portions of the flowers are hung out as mere advertisements, to attract insects; that surplus pollen and nectar are placed in the flowers as wages to reward and encourage their visits.

Some knowledge of botany, at least, is essential to aid the judgement in selecting with intelligence the sorts that may be crossed or hybridized. It is also often a great help to a person in quickly detecting some vile weed which has just made its appearance, while the unbotanical might scatter quickgrass and other troublesome pests far and wide over his premises before he became aware of their presence. A knowledge of the shapes, sizes, colors, markings and internal structure of seeds is valuable to the horticulturist, enabling him to distinguish the true from the spurious.

The trained eye of a botanist is necessary to aid one to see beauties, defects, harmonies and incongruities in selecting, combining and arranging trees, shrubs, flowers and foliage plants to best advantage for producing the most pleasing effect at the least outlay of money and labor.

The man who knows the structure of a tree and how it grows, would at least be amused at the following statement, once made by a "practical" man at a meeting of a state horticultural society. To kill the insects on leaves, to add health and vigor to a fruit tree and cause it to produce abundantly of luscious fruit, he bored a hole into the trunk of the tree, filled it with flowers of sulphur, and secured it with a plug. He was careful to avoid boring very far into the tree because he might thereby injure its heart! A knowledge of vegetable physiology teaches a person the effect on a plant of flowering, of seeding, of high cultivation or poor cultivation, of root pruning, of pruning the top at different seasons of the year. It teaches how to manage plants for producing flowers, and how to manage them to prevent their flowering.

A person might as well attempt to become a surgeon without a knowledge of human anatomy and physiology as to become a horticulturist without botany. The horticulturist who merely learns the trade will not so quickly change his practice and adapt himself to the new circumstances of a different climate in a remote country, as the one who has studied well the principles of plant growth. Many worthless experiments have been made, wasting time and money, attributing results to wrong causes, from a lack of a knowledge of plants.

No horticulturist without a thorough knowledge of the principles of several departments of botany is capable of planning and conducting and interpreting experiments. Think of the time occupied in making experiments, in discussing the subject in the press and in conventions on the cause or nature of pear blight!

In horticulture, in most respects, botany will make a person more capable. It will make him a good observer, improve his reason, strengthen his judgement, cultivate his taste, broaden his views, weaken his respect for the traditions of his fathers. It will sharpen his wits, make him a reliable investigator. It will enable him to become a leader instead of a follower.

Who, not a botanist, could ever have imagined half of the bright thoughts stated by Asa Gray in his essay "Were the Fruits Made for Man, or Did Man Make the Fruits?" Here, among other things, he discusses what our pomology would have been if the civilization from which it, and we ourselves, have sprung, had had its birthplace along the southern shores of our great lakes, the northern

(*) The reader who desires to pursue this subject further is referred to Rep. Mich. Pom. Soc. 1873, Proc. Amer. Pom. Soc. 1879 and 1881, Amer. Naturalist 1886.

shores of the Gulf of Mexico, and the intervening Mississippi, instead of the Levant, Mesopotamia and the Nile, and our old world had been open to us as a new world, less than four hundred years ago.

Who, except the botanist—Darwin—could have written two of the most suggestive and valuable works ever produced as guides to the horticulturist? These are, first, "Animals and Plants under Domestication," second, and in my opinion most valuable of all books to the horticulturist, "The Effects of Cross and Self-Fertilization in the Vegetable Kingdom."

The former is the easier to understand and the more popular—it has been much read and quoted, and has already made a lasting impression on horticulture; the latter has yet apparently scarcely produced an impression, and was undoubtedly written in advance of the times.

The Gardeners' Chronicle remarked, upon the advent of this latter book: "For our horticultural readers the great value of Mr. Darwin's last work consists in the practical applications which follow from the author's very numerous, protracted and laborious experiments, *yet it is certain, that those practical results will be a long time filtering into the minds of those who will eventually most profit by them.*" The lines which I have italicised are prophetic.

It is now over fourteen years since this book appeared, yet we have heard of scarcely any horticulturist who have practiced what Mr. Darwin showed to be advantageous. I have heard of nothing that has since been done in a practical way, in Europe, to confirm or disprove the experiments of Mr. Darwin. In this country, I have not heard, as I now recollect, of a single instance of experiments in this line, excepting some which I conducted soon after the book was published.* These results were presented at several conventions and a report printed in several journals, yet no one seems to have taken any note of them.

The following from Mr. Darwin's book should be committed to memory by every progressive horticulturist: "It is a common practice with horticulturists to obtain seeds from another place having a very different soil so as to avoid raising plants for a long succession of generations under the same conditions; but with all the species which freely intercross by the aid of insects or the wind, it would be an incomparably better plan to obtain seeds of the required variety, which had been raised for some generations under as different conditions as possible, and sow them in alternate rows with seeds matured in the old garden. The two stocks would then intercross, with a thorough blending of their whole organizations, and with no less of purity to the variety; and this would yield far more favorable results than a mere exchange of seeds."

A thorough knowledge of botany will every day add much to the pleasure and satisfaction of the horticulturist, as plants in various conditions in the ever changing seasons are everywhere about him in great variety and profusion. Such knowledge is indispensable to enable him to receive the greatest benefit possible from a visit taken in any country at any time.

I must say a word in regard to that garden fence which is mentioned in your May leader, "A New Science." Thirty or forty years ago, nearly all the gardens to be found on our best farms were surrounded by a high picket fence to keep out the hens, the pigs, the puppies and stray cattle. It also served pretty effectually to keep out the horse and cultivator and a regular and liberal supply of barnyard manure. Within such enclosures, small fruits and vegetables were usually much neglected, few in quantity and poor in quality, or if well cared for, the labor was performed by hand at great cost of sweat and muscle. More recently, in place of the picket fence, an evergreen hedge has sometimes enclosed the garden patches, but in modern times, tidy farmers usually keep fowls, swine and other live stock securely enclosed, and have torn down, carried away and abandoned the garden fence altogether. Even the evergreen hedge is not now considered essential. As the farm garden has now become more easily accessible and better planned for convenience, for tillage by horse and cultivator, it is better kept, more interesting, oftener visited and more profitable.

Considering all of these modern improvements, including a much greater assortment of fruits and vegetables of new or improved sorts, and also observing of late the increased enthusiasm and intelligence given to horticulture, the botanist is more than willing to call around occasionally to visit the gardener, look over his asparagus, praise his lettuce, test his strawberries, and see how his cantaloupes are progressing. Perhaps the older botanists neglected the garden because of the formidable pickets of the fence, the want of interest manifested by the proprietor and the poor show for "garden sauce." But since things have improved, botanists are becoming more attentive. Darwin has already observed the roots of the turnips, the bulbs of the onions, compared the cabbage heads, studied

(*) See Amer. Journ. Sci. and Arts, May, 1879.

the curling tendrils of the vines, examined the peas in the pod, told how the bees benefit the bean crop, and how and why the slender stems manage to climb to the top of the poles and swing around in seach of objects still higher. He has not neglected the esculent tuber from America, nor forgotten to grapple with the changes of cion as affected by the stock.

Many other botanists have already condescended to examine, often suggesting remedies for anthracnose on wax beans, mould on lettuce, rot on tomatoes, smut on onions and sweet corn, and rust on blackberries. And above, the reader has just seen that some systematic botanists are beginning to see that the berries, the pomes, the drupes and the vegetables of horticulture are worthy of their attention and careful study. With a very little advertising, some fruits in place of leaves to pay for his visits, the botanist will describe and classify in workmanlike manner those cabbage heads; the beets and carrots, and potatoes will receive like attention, and even those hybrid strawberries, roses, pelargoniums and castor-oil beans will yet be perfectly described and after some fashion classified, though owing to former neglect of the proprietors, these plants may not be eligible to record on account of defective pedigrees.

With a little more attention to his own intellectual improvement, as well as to be able to raise larger crops of rhubarb, egg-plants, cauliflower and finer hollyhocks, there need hereafter be no fear of neglect of the botanist to lend a helping hand wherever he can make himself useful. He is already beginning to make photographs and herbarium specimens, so far as practicable, of all the sorts of vegetables, fruits, flowers and foliage plants, not only of the edible portions at the proper stage of growth, but likewise the buds and flowers. He is giving much attention to the seeds of plants, also, their structure, vitality and points for classification. With the advent of the agricultural college and the experiment station, the botanist hereby solemnly promises in the future to be more attentive to the wants of the neglected sister, horticulture. Flora and Pomona shall henceforth begin to regain the homage paid them in the days of Homer, and much good shall follow the worship of the sisters.

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ACKERMANN'S PHYLLOCACTUS (*Phyllocactus Ackermanni*).

Fig. 1, Frontispiece.

Phyllocactus Ackermanni, Haworth, Synopsis Succulentarum, 1819. *Cereus Ackermanni*, Lindley, Bot. Register, t. 1331.

The species of the genus phyllocactus, which, all things considered, is undoubtedly the most important genus among cacti to the florist, naturally fall into two series: the first series is characterized by red or deep pink flowers, which persist for more than a day, and the second by flowers which are white or whitish inside and are usually sweet-scented, and some of which are ephemeral. In the red-flowered section, *Phyllocactus Ackermanni* is undoubtedly the most valuable species. The flowers are a bright shining crimson, and measure from six to eight inches across. The outer sepals are small and bract-like and more or less scattered, a character which distinguishes this species from *P. phyllanthoides*. It is one of the freest bloomers of the genus. The species is particularly interesting from the fact that it has been a parent of many interesting and valuable hybrids. It has been hybridized even with *Cereus speciossissimus*, and probably with other cereuses. Hybrids between it and *Phyllocactus crenatus* are well known. In fact, *P. Ackermanni* itself was at one time supposed to be a hybrid, but the evidence now appears to be clear that it was taken to Europe from Mexico early in the century by George Ackermann, for whom it is named.

The other important garden phyllocacti are as follows:

A. FLOWERS RED—

P. phyllanthoides.—This is one of the best known species, and one of the freest bloomers. The flowers are about half the size of those of *P. Ackermanni*, and the outer sepals are long and spreading. The color is usually disposed in irregular streaks of bright rose and white.

P. biformis.—This is the disocactus or disisocactus of Lindley. It is at once distinguished from all other species by its flowers being terminal on the branches, and by the very few sepals and petals. The flowers ars rosy pink, small and short-lived. The plant is erect, rarely reaching 3 feet. It is regarded as intermediate between phyllocactus and epiphyllum. In an ornamental way it is probably the least valuable of the genus.

B.—FLOWERS WHITISH-CENTERED, RANGING FROM YELLOW TO ORANGE OR PINK ON OUTSIDE; USUALLY FRAGRANT.

P. anguliger.—A singular species, characterized by large and blunt saw-like teeth or lobes on the