

Plants as Modified by Man.

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Ever since science overthrew the idea of spontaneous generation and established beyond doubt that no organism could have existence without a parent cell, the scientific world received a thunderbolt which was to be means of its first great awakening. And as the message was heralded from one to another it aroused more careful investigation, stimulated advanced thought and opened up a new line of possibilities respecting the whole plant kingdom.

Man did not grope as hitherto in the dark trusting to uncertainty but from a more scientific basis. This was the dawn of a new era from now henceforth man was not simply to assist nature in producing endless varieties, but be the actual progenitor of new creations.

I need only refer you to the excellent work of L. Burbank of Santa Rosa, California, to substantiate this statement. It is a well known fact that plants kept on the same soil and subject to the same environment for a long time become lower in vitality and less valuable for economic uses ; again, nature did not perfect her fruits and flowers to suit the fastidious taste of man but left this for him to do, and now he is exercising that right to a degree that was never dreamed of a few years ago.

The casual observer regards us as usurping more privileges than belong to us, but not so, just as the Chemist takes original elements or compounds, breaks up their combination or combines them into various proportions to suit his purpose, so we are at liberty to do the same with our plants and without violating nature's laws in the least. However, nature refuses to indulge man only just so far in his modifications of both plants and animals as we find hybrids in either case as a rule are sterile.

While a few have worked only from a standpoint of curiosity and the enrichment of science, the greatest work has been called forth from an economic standpoint. Extensive cultivation has taught to the horticulturist, farmer and florist just how to secure larger returns from a particular soil and a given surface than heretofore ; it has done even more than this, by carefully selecting, cross fertilizing and cultivation we have been able to double, triple and even quadruple desirable qualities we wish to perpetuate in our choice fruits and flowers.

Man is simply nature's agent or employee to assist her in her work, hence the more careful and scientific the man is the more valuable he is as an aid to nature in carrying out her plans methodically, instead of at random as is the case when left to herself to perform the work.

Darwin gives a great many fitting illustrations of how

nature does it, a few of which I will consider briefly. "In the first place we find that nature distributes her plants in a way favorable to cross-fertilization" and not only does this mixing and crowding together of species do this, but it doubtless encourages the survival of the fittest.

Nature seldom transplants her trees, rarely grafts and never buds. Upon examination of the roots of many of our forest trees we find a long straight tap root which goes directly downward which of necessity must be broken if transplanted, this gives the plant a shock from which it never thoroughly revives, and if this be practiced from generation to generation the result will be a whole race of plants much lower in vitality than the original unmolested stock. Some of our most eminent horticulturists deem the art of budding and grafting a curse rather than a blessing to horticulture, owing to the use of uncongenial stock; while many of our fruits and shrubs will unite with a great variety of stocks they do not make congenial hosts; hence, a weak short-lived plant is the result, i.e. in commercial circles certain stocks are used such as the Myrobalan for grafting the whole plum family upon, now this is not a congenial stock for certain members of this group.

A change in natural conditions tends to weaken our own plants. Man performs his work too suddenly, nature builds up her work slowly, man seeks to bring about the same results in one-half the time and as a result we invariably get a race of plants low in vitality, susceptible to the attack of fungus diseases and early decay.

Another way of reducing vitality is by the growing of monstrosities, the highest ultimatum of the plant in a state of nature is to produce seed, much pulp to her is waste and nowhere do we find her expending her forces upon waste material. Man is just the opposite, he wants much pulp. Nature is ready to accommodate him in this but at the expense of some other function of the plant, usually the production of seed.

Scientific research has taught us that everything in nature tends to strike an equilibrium, hence we are at liberty to shift certain forces here and there or in a way combine certain forces but at the expense of the part from which these deductions were made.

Experience has also taught us that the removal of trees from forestry conditions upon high, dry and arid regions is too sudden a change for them and hence a weakening of the plant is the result. It will be of interest here to look at some of the morphological characters of seeds and their dissemination. Nature calls into service many agents to assist her in scattering her seed; such as the wind, the waters and various forms of animal life. Many seeds like the dandelion, lactuca, cottonwood, etc. have long plumose appendages that fit the seed for being buoyed up by the wind and carried long distances. Some are fitted for enduring salt water for many days, others are provided with hooks and barbs that cling to whatever object they may come in contact with and are in this way scattered far and near. Others still seem to require the action of the gastric juices of the stomach, and the only way that man has been in any degree successful in germinating such seed is to imitate the action of the stomach as nearly as possible.

It is also well established that nature's plants are increased in size and vigor by varied environments. There are many other illustrations of interest that might be mentioned, but I trust these are enough to portray that thought in view. Summarizing these few remarks we might add, "That nature's methods are favorable to natural crossing, natural selection and exact climatic adaptation."

In man's manipulation the one thing sought for is purity of stock in fruits and flowers abnormal in size which we can readily see is a violation to nature's laws and hence must be done at the expense of vitality; such plants will survive and do well for a few years, but finally will succumb to the inevitable, and then are compelled to go back to some primitive form for a starting point again. This explains why the seed and plant catalogues are flooded every year with new varieties of sterling merit.

Every farmer, horticulturist and florist should know the few simple facts concerning atavism, reversion and sports (not a serious task, however,) then he would not only be able to work intelligently but greatly prolong the life, size and the vigor of his choice fruits and flowers and possibly be able to build them up to a higher degree of perfection.

Mr. Burbank, of California, is, doubtless, on the right track to the greatest revolution that horticulture has ever known, he has certainly unearthed many gems from the mysterious realms of nature, hitherto unknown; he has made a great number of successful crosses, a few of the most remarkable we append as follows:-

Peach X Almond.	Chickasaw plum X Jap. plum.
Peach X Japanese plum.	Apricot X Peach.
Peach X Chickasaw Plum.	Japanese plum X Peach.
Peach X Apricot.	Japanese plum X Chickasaw.
Almond X Peach.	Myrobolan X Japanese plum.
Almond X Japanese plum.	Domestic X Wild goose plum.
Apricot X Japanese Plum.	Crab X Common Apple.
Prunus japonica X Quince.	Quince X Crab apple.
Chinese quince X common quince.	Quince X apple.
Pyrus japonica X Chinese Quince.	Quince X Apple.
Japanese Quince X Apple.	Chinese Quince X Apple.

Potato X Tomato.

Some of these crosses are very remarkable, as you see, and are doubtless new creations.

One need not go to Europe, Asia, California and remote parts of the earth to find remarkable crosses and astonishing results, as our own College grounds furnish some very striking examples of what we have done and are doing in the way of evolution. This work has been in progress for a number of years, but owing to the difficulty under which much of the work has been performed the results are as yet unknown.

The work here on the ground has been promoted by two main objects, first the development of the science from an illustrative standpoint and second the possibility of building up a class of fruits and shrubs adapted to the soil and climate of the whole north and northwest which we are sadly in need of, owing to the ever increasing population and the growing demand for superior fruits and flowers. In this line of fruits some very interesting work has been done on

the plum, of which I shall make a brief mention.

Of the first group, tree No. 4 is a cross between the Desoto and the Japanese plum; the Desoto, of course, being the true American type. In leaf we have neither the Japan nor the Americana, but a combination of the two, the leaf is much thicker and closer in cell structure with net veining on the upper surface like the Japan, and the under surface like the Americana, serrations like neither. In bud it is like both, being double and triple. It evidently endures a drouth well as it has seemed to thrive during this most remarkable season on record during the civilized history of our country. Yellow leaves begin to show early in September indicating determinate growth (which is an indispensable requisite of a hardy plant of any description) showing, of course, that the elaboration of starch and ripening of the wood was complete. The shape of the tree is all that could be desired, being rather upright in habit with the limbs sufficiently spreading to aritate the fruit. The limbs are very strong and capable of supporting as much fruit as can hang upon them. The color of the bark is changed somewhat, but resembles that of the Americana more than the Japan.

Tree No. 3 of the same cross shows both Americana and Japan buds, also the color and peculiar spotting of the bark is distinctly Japan; the leaves are fully one-third larger than those of Americana with serrations like the Japan texture, thick and leathery. Venation same as No. 4. The tree is good in habit being very large and spreading and capable of supporting an immense quantity of fruit. One-half of the tree was split to the ground by a tornado that passed through the town June 17, and notwithstanding this severe injury, fully five feet of new growth was made, and the wound showed upwards of one-half inch of granulation, which goes to show that the tree possesses remarkable vigor and vitality. This tree has fruited twice, (in '93 and '94) producing a purely self-colored yellow fruit of a rather rich purpleish red on the sunny side, carries a heavy bloom, and is marked with a deep suture. In size it is as large as the Kelsey, free-stone, superior in flavor, and considered a valuable plum.

The next two of which I will describe are interesting because here we have a crossing of species, viz. the Desoto and Maquoketa.

Tree No. 1, in general appearance, is like the Desoto with double, single and triple buds, leaves smaller than either but thick and of good substance, habit low and spreading, wood like the Japan.

No. 2 of this cross has thick broad leaves serrated like the Japan, upright in growth and shows but few triple buds, wood like the Japan. It also shows a decided tendency to the early ripening of its wood.

No. 3, in general appearance, is decidedly Maquoketa but has a leaf like neither. At a later date I hope to take all of these up more fully.

The unquestionable hardiness of *Rosa rugosa* in connection with its beautiful foliage has prompted some very elaborate work with it here upon the College grounds. Pollen was used from our best cultivated roses in the East. The aim being to secure a class of roses equal in form, beauty and fragrance to those of our best Eastern varieties in leaf,

color of stems, size and vigor. Of those that have flowered, some have come semi-double, delightfully fragrant and of a pleasing shade of color, among those that have come single, some are very desirable in color. A few mildew, badly showing their weakness of constitution, and inadaptability to this latitude.

Much careful work has been done with the geranium, of which I will speak only in a general way as the work is by no means complete. Of a truth this can be said that they are more floriferous, larger flowers, more of them, purer in color, tints and shades, larger, more robust and beautiful foliage, both in the house and in the border. The increase in vigor is quite noticeable, even to the casual observer.

Some rare and interesting crosses have been made between *Amaryllis Johnsonii* and *A. Defiance*, also the beautiful fairy lily *zephyranthes atamoska* and *Johnsonii*. These are rare crosses and much is expected of them. Some promising crosses have been made between *Abutilon Golden-bell* and *A. Eclipse*. Also much work on the *Calla Lily*, the aim being to increase the size of the flowers by in and in breeding and selection.

We also have nine seedling plants produced from a cross made between our best double white geranium, and one of our new brilliant scarlets, but for some unaccountable reason three flowers came on the same head that were quite rich salmon pink, the cross was made with the above results. Some crosses have been made between *Nicotiana tabacum* and *N. affinis* with wonderful results, which I will be pleased to mention in detail later. One new border plant has been added to the list of encouraging sports of *Mad. Saleori* geranium and carefully selecting the same. Three new chrysanthemums, of merit, have been added to the list, and several others that show promise. The department has made a great number of crosses between our cultivated strawberries and the *Manatoba* wild one that present an almost endless variety of modifications, which I will describe later. Also much systematic work on the apple, pear and grape has been done, but desire to give them future notice.

In regard to what has been done, one need only refer to the many excellent books and periodicals on this subject. Of what we may do is of much deeper interest to us. With the light that our past and present experience has given, the wide range of possibilities are beginning to dawn upon us. Horticulture has, indeed, a broad foundation upon which to build a mighty structure. The agents to aid him in his work are, in brief, these:-

1. A change in environment.
2. Cross fertilization.
3. Cultivation.
4. In and in breeding and selection.

No. 4 is by no means of minor importance, since the scientists have established beyond question that not only such a thing exists in the plant kingdom as heredity, but that it is very characteristic. Vegetable pathologists recognize the fact that certain diseases can be transmitted from one plant to another, as in the case of the frenching and bleaching of leaves. Its first appearance, to be sure, is a sport, but by

selection, budding and grafting, the type can be fixed so that it will reproduce itself with unerring certainty, and some of them have been so well fixed as to come fairly true from seed and this is likewise true of all characteristics.

With these few mile-stones to guide us in our course, dare we not predict that the day is not far distant when man's workshop need no longer be chaos, but will be able to use the tools nature has placed before him from a purely scientific basis, free from all conjecture.

Why should not the horticulturist know just how to build up size, flavor, vigor and hardiness in his fruits and shrubs, and the florist know just how to proceed to unite, blend and perfect the color of his flowers, producing not only harmony, but a glorious symphony of nature's daintiest tints and shades, with just as much certainty as the artist mixes his pigments upon the palette, and the novice go on with his new creations until nature refuses to indulge him longer?