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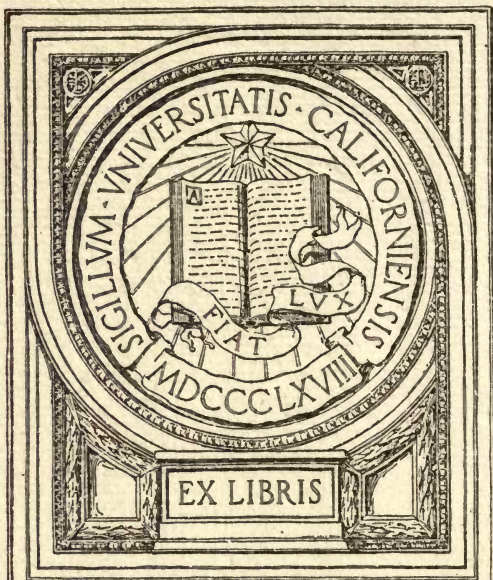
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CALIFORNIA  
FIG INDUSTRY  
FROM THE ANNUAL REPORT OF THE  
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# FIG INDUSTRY,

WITH A CHAPTER ON

## FIG CAPRIFICATION.

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Written for the Annual Report of the California State Board of  
Agriculture for 1891,

BY B. M. LELONG,

Secretary of the State Board of Horticulture of California.



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## CALIFORNIA FIG INDUSTRY.

By B. M. LELONG, Secretary of the State Board of Horticulture, and ex officio Chief Horticultural Officer.

The fig is probably the oldest of all cultivated fruits. It is mentioned in the first book of the Bible, and is more frequently referred to in both the Old and New Testaments than any other fruit. Herodotus alludes to it, and in the early history of our race it played an important part among food products. The Greeks received the tree from Caria, whence its name, *Ficus carica*, but improved the fruit so greatly that Attic figs became celebrated and were in large demand, so much so that stringent laws regulating their export were enacted. Pliny mentions several varieties, and alludes especially to that produced in Ebusus as highly esteemed by Roman epicures, and mentions the Roman fig as supplying a large part of the food of the slaves, especially of those engaged in agricultural pursuits, by whom large quantities were eaten raw at the time of the fig harvest. It is probably a native of the eastern Mediterranean regions, but has spread from its original home over a large portion of the known world. It is to-day found in all the warm, temperate, sub-tropic, and northern tropical zones. It flourishes on the plains of northwestern India, on the Himalayas to an elevation of five thousand feet, in Afghanistan, northern Persia, Asia Minor, Palestine, northern Africa, and the warmer parts of Europe, ripening its fruit in sheltered places, even so far north as the southern portion of England. It has been naturalized in Australia, the north island of New Zealand, Chile, California, and other portions of the United States. It flourishes in Florida and the Southern States, and will grow and bear fruit in the open air of some of the Middle States with proper care. In California, of all the States in the Union, it appears to attain its most thrifty growth, and some trees now growing in this State are phenomenally large. Immense trees, the largest in this State, of the White Adriatic fig, grow at Knight's Ferry, in Stanislaus County. They bear enormously, and are a source of great profit to their owner.

One of these is sixty feet in height, its branches shading a circle of seventy feet diameter. At its base the trunk is eleven feet in circumference, and at three feet from the ground it is nine feet around. Several large branches divide the tree a little above this point, each of which has a circumference of nearly five feet; while at a distance of thirty feet from the ground the limbs have a diameter of seven to eight inches. The largest grove in this vicinity consists of fifteen massive black fig trees, set at a distance of sixty feet apart, yet intermingling their boughs overhead until a dense shade is formed beneath them.

At Rancho Chico, in Butte County, is a fig tree planted in 1856, which measures eleven feet in circumference one foot from the ground. Its branches have been trained to the ground, where they have struck root and formed new trunks, until they cover an area of a hundred feet in diameter.

California possesses very much the same requisites in soil and climate that are possessed by the fig-growing sections of Asia and Africa, where the finest fruit is produced. In response to a series of questions propounded by the State Board of Horticulture regarding the fig in foreign countries, a great deal of useful information was elicited in regard to the habits of the tree, methods of cultivation, and preparation of the fruit; from these sources the information presented in regard to this important fruit in other lands is gathered.

Morocco produces a large variety of most delicious figs; they are called by the Arabs "Kermuse" in general, although each variety has its name. There are figs of various colors, some of which are white, yellow, black, purple, and others green. The Jews extract "aguadiente," an ardent spirit, from figs. In Spain they prepare a savory wine, from which a spirit known as "anissette" is extracted.

In Palestine, while no figs are grown for market, and scarcely any attention is given to the care and cultivation of the tree, there are said to be as many as twelve varieties of the fruit, and with few exceptions all are good for table use. The best known are the large green, early-fruited fig, known as *dafonri*; small green later fig, called *ghondri*; large purple fig, named *gharroubi*; a small purple fig of the same name; yellow fig, white inside, known as *biadi*; yellow, with crimson inside, called *karawi*; and the black fig, known as *swadi*. A great many figs are preserved for future consumption, and the three last named varieties are the favorites for this purpose. The tree flourishes all over Palestine—up into the hill country to an elevation of three thousand feet or more—and frequently attains an enormous size, even on the most rocky hillsides, and whether the land is hilly, rolling, or level, appears to make no great difference to them.

In Syria the best fig for drying is the green variety; the best for table use is the red pulp variety, known as "Buckaraty," a favorite, also, is a rounder variety, known as "Seedany." The trees grow on both plains and hills, and from the shore to a distance of twenty-five miles inland, and to an elevation of two thousand five hundred feet.

In Tripoli fig trees grow on the plains as well as on the mountains; the more they are exposed to the sun the better they prosper. They are found in rolling and level land, both of which are adapted to their growth. It is customary in this country to plant fig trees in either white clayey soil or in a blackish soil—the latter not being good for other kinds of trees.

In France the fig grows in an almost wild state in many places. On many an old wall small fig trees are to be seen, and on many a road-bank they are the trees most frequently to be seen. In country farm-yards, innkeepers' gardens, and stable-yards the fig tree is invariably present, and very often as a solitary specimen. It would be difficult to find a garden of any description in southern France without a fig tree.

In Italy many varieties are cultivated. Usually the fig is planted in company with other fruit trees—the olive, almond, and others—but fig orchards where figs alone are grown may be found at Lecce and other places, and in such cases the trees must be planted at such a distance apart that when they reach their fullest development they may not come in contact with each other. In many places it is the custom to alternate the fig, almond, and olive, so that each fig tree may be isolated. The introduction of the fig into Italy antedates authentic history,

and is lost in the misty depths of tradition. Pliny refers to a tree which existed long anterior to the founding of Rome, under which the people of that city were wont to assemble to discuss the topics of the day years thereafter. Tradition claims this tree to have been that under which Remus and Romulus were found, and in commemoration thereof it was preserved.

The fig grows spontaneously in the arid wastes of Greece, Asia, and northern Africa. In countries where the thermometer does not fall below 59 degrees Fahrenheit, the growth and maturity of the fig proceed without any appreciable interruption; but in colder countries, upon the advent of the first frost the fig tree loses its leaves and those seed receptacles which, under favorable circumstances, would have continued to develop, harden, and remain inert until the following spring, when, with the return of warm weather, they resume their growth, being the first to mature in the summer. The figs thus resulting are denominated "fig flowers," in order to distinguish them from those which first appear in the spring and mature later.

In hot countries the fig tree grows to large proportions, and in isolated and favorable localities it assumes a beautiful form without need of modification or pruning. Its branches project themselves regularly toward the earth from year to year, and finally reaching and entering it they throw out new roots, thus forming additional sources of propagation.

The fruit of the fig tree may be reckoned among the staple food of man for ages before cereals were cultivated by any settled agricultural population. In the temperate regions, where it thrives best, it fills the place of the banana of tropical climates, and yields fruit during several months of the year. In Asia Minor, where the tree is found wild, and where the best figs of commerce are grown, it is extremely fruitful.

The best figs for drying come from the valleys of the Meander and the Kaistros, to the south of Smyrna, where the trees are planted with great regularity and care, and the ground is dug and hoed from four to six times during the summer. When the figs reach Smyrna they are sorted by women and packed in boxes by men. They are the best when newly packed, and as months go by get drier and harder in the warehouse.

Although throughout the world there are to be found more than a hundred different species of figs, only some five or six are cultivated in Turkey, from whence we get the fig of commerce. Of these the best are grown most largely and in greatest perfection around Smyrna, but considerable quantities are also grown in other parts of Asia Minor. The fruit is of various colors, from deep purple to yellow, or nearly white. The trees usually bear two crops, one in the early summer, from the buds of the previous year, and the other in the autumn, from those of the spring growth. The last forms the chief harvest. The *Ficus carica*, from which the commercial fig is produced, is a tree rarely more than eighteen or twenty feet in height, with broad, rough, deciduous leaves, very deeply lobed in the cultivated variety, but in the wild plant nearly entire. After the young tree attains maturity it receives but little care beyond being occasionally lopped in places and being well manured in the fall of the year.

A remarkable feature of the fruit of the fig tree is, that it grows and ripens without any apparent blossom. The edible part, however, is not a fruit proper, but a hollow receptacle which contains the flowers, and in the mature fig, the fruit. This fruit is composed of numerous small

seeds imbedded in the juicy pulp of the receptacle composing the fig. The flowers are very small and unisexual, the male flowers occupying the upper end of the cavity, and the female flowers the lower portion.

The question of fertilization of the female flowers of the fig is a vexed one. ~~In many varieties the pollen of the male flowers fertilizes the female flowers of the same receptacle, and the fruit matures; but with~~ other varieties, notably the Smyrna, this process does not become complete, and the fruit drops from the tree when half grown. So inferior has been the fruit of the Smyrna fig when grown in California, that the question is seriously raised as to whether the true Smyrna fig has ever reached us. Of this, however, there is little room for doubt, as cuttings and rooted trees from authentic sources have been received and propagated in this State. Consul Emmett, of Smyrna, in his report says that in 1886 a party from California, apparently well posted, went there in the summer, visited the fig district, and inspected the different varieties; he made his selection, and marked the trees from which he desired cuttings. When the crop was gathered he obtained thirty thousand female and three thousand male cuttings, which were packed and shipped about the end of October. To still further set at rest the question of the authenticity of the Smyrna fig in California, during the past year the State Board of Horticulture procured direct from Smyrna a shipment of fifty well-rooted four-year old trees. These arrived in excellent condition, and were distributed over the State. Over two thousand applications for trees were made to the Board, and out of these careful selections were made, considering locality and facilities for cultivation and care. Reports received from some of those who received these trees show that they have done well, in some cases a growth of over two feet having been made. The wide distribution of these trees gives an assurance of a thorough trial of the Smyrna fig in the various sections of the State, and a guarantee of the spread of the genuine fig of commerce.

That we have growing in this State the genuine Smyrna fig tree is almost beyond question, but whether it will ever prove profitable is still a question. It is claimed by some that the dropping of the immature fruit is due to lack of age in the trees, and by others to the incapability of self-fertilization in this variety. In Asiatic countries it has been the custom from time immemorial to hang fruits of the wild or caprifig on the limbs and boughs of the domestic fig tree, under the impression that the pollen of the male fig was conveyed to the female by means of a small fly known as the Blastophaga. While this practice is considered as an absolute necessity by the Asiatic growers, who inherited the tradition from their ancestors for a remote period, those who have given it a thorough scientific investigation declare it not alone useless, but detrimental. This subject was exhaustively dealt with by Professor Gasparini, a translation of whose valuable paper thereon is given elsewhere. However, whatever good the Blastophaga may be capable of accomplishing in the way of assisting in the fertilization of the fig, California may now hope to participate in, for, owing to the efforts and enterprise of Mr. James Shinn, of Niles, we are now in possession of this insect.

The fig growers of this State were and had been anxious to have the insect introduced, so that its merits pro and con might be established. To this end the entomologist of the National Department of Agriculture was asked to procure the insect from Smyrna, as the facilities of Government officials in such matters are well known. In the June number

(1891) of "Insect Life" he says that efforts would be made to introduce the insect into our State, but as to what efforts were made nothing has been heard. I should not be surprised in the least if in some coming number of some publication, he broaches the claim that the credit of introduction belongs to him, as scarcely a bug has been introduced or discovered of which he has not claimed first credit, and, as one of our Congressmen expressed it to the members of the State Board of Horticulture, "He not only wanted to make me believe that he discovered the bug, but had also produced it." "What egotism! how selfish, oh man!" Officers of this kind should lay aside all ambition for notoriety at the expense of the public, and when their deeds become known the people will show them their gratefulness. But a man who has such a disregard for the truth cannot but be held in contempt, and if they could only see their vanity, how different things might be, and the Government would not be taxed with the burden of printing and circulating their vanities (an insult to science), and, furthermore, of employing an editor to prevent one man from appropriating the credit due to others; and why this state of things should be allowed to continue the public ought to know.

As to the manner of the introduction of the Blastophaga, I cannot do better than to give Mr. Shinn's own account: "We wrote to some friends that were known to us in Smyrna; or rather, some missionaries were stopping at my house, and seeing that my fig did not bear, and that I was getting uneasy about it, one of the ladies, my wife's sister, said she knew a lady from Syracuse, New York, who was then in Smyrna, and if she would write to her she would fix up a few of the fig cuttings and send them. The lady sent for them, and instead of sending a half dozen cuttings, sent a whole box of cuttings, on which I paid about \$100. After I received this box, here comes another little box and a letter, saying: 'The figs must be caprifigged; if not you will get no figs. I send you a little box of figs that are full of the Blastophaga, and hope you can do well with them.' The moment we got them my son went out to the caprifig tree, opened the box and set it out there. Some of the insects were dead and some were alive. I saw Mr. Eisen the next day, and told him about the Blastophaga and the figs. He and Mr. Maslin came to my place the Sunday following, July 26th. We examined and found some live insects, but most of them were dead. The Smyrna figs that were caprifigged, that is, that had the pollen put in artificially, came to perfection, but no others did. Two crops have all gone to the ground and are now on the ground, except about ten figs. The pollen that was injected into the figs was from the caprifigs grown on my place at Niles. There are two varieties of the Smyrna fig. One has a three-lobed leaf, and the figs are small and elongated. The other is a five-lobed leaf, and the figs are flat and roundish."

The ground for argument by those who believe in caprifigation, has been that no fertile seeds had been found in any California-grown fig. Also, that all figs, and especially the Smyrna, only contain female flowers; and the fact of fruit of trees imported from Smyrna not coming to perfection, gave them stronger grounds for such belief; that is, the pollen of the male, or caprifig, had to come in contact with the flowers of the female fig to produce fruit. Also, that the reason for not having found kernels in the seeds of California-grown figs was attributed to the lack of the pollen fertilization.

On October 20, 1891, while visiting an orchard at Los Gatos, I came across a tree which attracted my attention by reason of its being of peculiar foliage; and upon cutting the fruit I found that it possessed both pistillate (the female organ of a phænogam, consisting of the ovary with its stylus and stigma) and staminate (the pollen-bearing organ of the flower, consisting of an anther usually supported upon a stalk or filament) flowers, which were so grouped that the pollen from one was freely conveyed to the other. Thus fertilized, the female blossoms had developed into hundreds of perfect seeds with well-defined kernels.

This is the first time that fruit of this character has been found in this State; that is, containing both pistillate and staminate flowers, and the seeds perfect kernels. One of the specimens cut in the presence of E. W. Maslin, Secretary of the State Board of Trade, and G. F. Weeks, agricultural editor of the San Francisco "Chronicle," was full of pollen; in fact, the pollen was so abundant that it gave the center of the fig a yellow appearance. Unfortunately, the figs were not fully matured, so there was no opportunity to test their quality. On cutting them open they were of a decidedly purple hue near the skin, changing to bright red and to deep red in riper specimens. Hardly any red coloration was visible in greener specimens, the entire flesh being a deep purple. The fig is of elongated shape, rather small, and resembles the elongated fig grown by Mr. Shinn, both in shape and color of flesh. It has a leaf resembling the Smyrna, finely lobed.

Afterwards Mr. Maslin brought to my office several seedling Smyrna figs grown by him in Placer County. The specimens were small, of a bright amber color, and the fruits in the receptacle well developed and ripe. Upon examination they were found to contain numerous male flowers and considerable pollen. We have here two conclusive facts, showing that the insect is not altogether essential for the setting of the fruit, in some figs, at least.

This is a progressive world, and its people, step by step, have unraveled many of the most difficult problems; so let us hope that wisdom and ingenuity will in the near future solve this interesting question.

The subject of caprification of the fig is dealt with so exhaustively and ably in the report of Professor Gasparrini, that nothing further need be said of it in this place.

The fig is a deciduous tree, and requires about the same degree of temperature to ripen its fruit to perfection as does the olive, although it will ripen its fruit where the olive will not. In fact, conditions suitable to the one will be found favorable to the other. Its fructification and vegetation are uninterrupted where the temperature does not fall below 53 degrees Fahrenheit. Where the temperature falls below this the leaves fall, and the fruit presents a peculiar phenomenon. A branch only develops and ripens part of the figs borne upon it—those on the lower end, nearest the stem. The immature figs at the farther end of the branch have their growth arrested by the first cold weather, and remain dormant during the winter, resuming their growth the following spring, and ripening in the summer. These are known as "first figs," or "summer figs." Those which commence their formation in spring on the lower part of the branches are called "second figs," or "autumn figs." In our warm climate there are thus two crops from the same tree every year. In colder climates the "first," or "summer" figs form the whole crop, as autumn figs can only be produced in unusually warm seasons.

In a warm climate the autumn crop will yield most figs, which are sweeter, less watery, and better suited for drying than summer fruit.

The fig is the faithful companion of the olive and the vine, and where these two plants thrive it also grows and fructifies. It is necessary, though, that the plants be never subjected to a cold more intense than 14 degrees Fahrenheit. If the temperature exceeds this limit it is necessary to head the fig very low, as is practiced at Argenteuil, in France.

#### VARIETIES.

The long cultivation to which this plant has been subjected, in greatly different countries, has given rise to a very large number of varieties, a few of which only were known to the ancients. In fact, Cato mentions but six, and Pliny, two centuries later, carried the number to about thirty. Thus, by the side of the figs of Tivoli and Herculaneum, mentioned by this writer, are indicated those from Rhodes, Lydia, Hyrcania, and others, which, like the *Liviani*, the *Pompeiiiani*, got their names from their introducers and propagators.

To-day the number of fig varieties is so great that it would require a long study to be able to describe them all, and such a task would not be one of the easiest, inasmuch as a great many of these varieties possess some peculiar characters and habits, which might be observed and recognized through experience, but could not be described exactly without much difficulty. Suffren, who lovingly devoted himself to the study of the varieties of figs which were cultivated in Provence in his time, found that their number exceeded several hundred. The figs may be classed into two large groups, the first of which comprises the varieties that yield only one crop of fruits a year, be they early or late, and the second, the other varieties which to the first yield add another, called September fruits, to distinguish them from the first, which are called flower, or first figs.

The fig will do well in any soil, but prefers a dry, friable earth. In fact, it will do well on a greater range of soils than will most of our orchard trees. Black, heavy adobe soil, however, should be avoided, as should also damp, marshy land. The fig tree requires a good deal of moisture, but not too much, and will frequently show its best results in the irrigated foothills.

The conditions required for the production of figs for drying purposes are far more exacting than are those required in the production of fruit for table use. The latter will thrive and yield good results under conditions unfavorable to the former. Table figs can be produced over a large area of the United States, covering most of the Southern States; but it is not probable that California will ever meet a formidable competition in the production of dried figs, in which she will yet excel. Travelers who have visited both sections remark on the great similarity of the soil and climate of our interior valleys and those of Asia Minor, where the best dried figs are produced. The seasons there, as here, are divided into the wet and dry. The winter rains commence in November, and continue until the following May; from May until October is the dry season, during which season rain rarely falls, and the ripening and drying of the fruit is not retarded. Occasionally heavy showers fall during the summer months, and these are as much dreaded there as are their counterparts in California. In the favored localities of

Smyrna the thermometer's extreme range is from 90 to 100 degrees in the shade; 130 to 140 degrees in the sun as the highest, to 26 degrees as the lowest. A heavier frost, however, will not do serious injury to the tree or injure the crop.

The same climate that suits the olive is favorable to the fig—a warm climate, where excesses of heat and cold do not exist. It is worthy of note that on the right side of the Rhone, in France, figs do not develop very well, the fruit remains small, and is not good for drying; whereas on the left side, and from the Rhone to the Italian frontier, figs attain a far higher degree of quality; they are larger, sweeter, more delicate, and are excellent for drying. The explanation of this fact is that the plains and districts on the right side of the Rhone are not sheltered by hills as on the other side. Sheltered hillsides are very favorable to fig culture, and exposure to cold winds is not conducive of good results.

The soil in Smyrna and vicinity is very variable. It contains a fair percentage of lime and potash, but is otherwise of various qualities. The most luxuriant growth is obtained in a deep, rich soil, but the best figs are grown on a soil which is made loose and porous by a fair admixture of sand. A sandy loam is thus the best, probably because the drainage is here the most perfect. Such soils produce large figs, of a white, thin skin, of high flavor and great sweetness.

In aspect, the Meander Valley resembles our lowest foothills—small valleys, separated by low ridges, during the dry season as uninviting as the foothills of the Sierra Nevada or the Sierra Madre. Some of the fig orchards are planted on hill land, and some in the valleys, neither locality having any decided advantage over the other. The valleys and plains generally give thickest skinned fruit, the skins of the mountain figs being considered thinner. In rainy or foggy weather the mountains or hills dry up the fastest, in this respect showing a decided advantage over the low, perhaps swampy plains.

#### PROPAGATION.

The propagation of the fig is very simple, and can be multiplied in various ways, viz.: by suckers (shoots that spring from the roots), by layers, and by cuttings.

*Suckers.*—The young shoots that spring up from near the base or crown of the tree, are called suckers. They generally contain a small portion of roots, which, upon being transplanted, soon form trees. The wound made on them by removing from the parent tree soon heals over. There are, however, great objections to trees produced from suckers. First among all is, perhaps, the fact that the sucker generally contains a portion of bark from the parent tree, from which many shoots or suckers put forth; also, the growth is not well formed, resembling water-sprouts, having but a feeble body, and as they are required to be topped in order to branch out, put forth feeble shoots which the body of the tree cannot support. In such cases it is best to allow such trees to grow the first year without trimming to form their body, and the second year the trees can be pruned as desired; in this way they become more healthful.

*Cuttings.*—There is no better way to propagate the fig than by the simple method of *cuttings*, which is the most practical, and above all the best. By this method nearly every part of a tree can be utilized.



The best season for the propagation of the fig by cuttings is through the months of February and March, the cuttings at this time being taken off while the trees are quite dormant. Great care must be taken that no cuttings be cut after the sap is in motion, because the milky juice which is produced so abundantly prevents the rooting of the cuttings. This, however, has no reference to young shoots in summer, which, towards autumn, when the wood is ripening, root very readily. The best cuttings are from stubby, short-jointed, well-ripened wood; they grow the most readily. One-year old wood is generally the best age for cuttings, although two and three-year old wood also does remarkably well, though no eyes may be visible. The long, spindling, badly ripened shoots, like water-sprouts, suckers, and such as are produced where the wood is crowded, are very difficult to make grow, and those that do grow require age to become thrifty trees.

#### PRUNING.

Pruning should be performed as soon after the fall of the leaves as possible, in whatever situation the trees may be. When trees are pruned at that season, they being then dormant, no injury is sustained; while if the operation is delayed until late in the spring, when the sap is again in motion, and there being such a volume flowing, the shoots are apt to die after being cut. The success of the fruit crop greatly depends upon the method of pruning.

It has often been claimed that the fig tree never bears when once pruned; this is, to a certain extent, correct, but the real cause is entirely owing to the immaturity of the wood, caused by pruning, which fails to produce fruit, or to the fruits being produced and failing to ripen. If the fruit-bearing shoots are cut back the first crop of fruit is destroyed.

Fig trees having non-bearing shoots can be pruned without any loss of fruit. If a fig tree is pruned to any extent, there will be a loss of the crop; however, such operation at times must be performed to keep the trees well balanced and within form, although this only affects the crop of one season. After the tree has been properly balanced and shaped, whether high or low, then pruning can be effected the following year with a certainty of a crop the same season; in such case the shoots must not be cut, excepting just a few here and there to keep the tree well balanced.

All such shoots which bear only wood buds should be cut back, and, if necessary, cut out entirely, as they only take away nutritious sap which should flow into the fruit and into fruit-bearing wood. Branches of almost any age or size can be cut off from any part of the tree, and young shoots will be produced quite freely, but the cuts or wounds should always be covered with grafting wax or rubber paint, which helps them to heal over and protects the stock from the action of the atmosphere. If too many shoots are thus produced, they can be reduced when young to the required number.

#### FORMATION OF THE TREE.

The proper formation of the tree next presents itself for consideration, with a view to the simple production of fruit. The formation of the tree requires the exercise of knowledge and understanding. All fruit

trees which naturally assume a bushy form should have their energies confined to a single stem, with the head of the tree, of whatever character, formed thereon, and they always prove the most fruitful. When a number of shoots are allowed to spring from the root, all striving to outstrip one another, a huge unshapely bush is the result. Fig trees, as a rule, produce suckers (shoots from the roots) in abundance, which, even if they have a fine, healthy appearance, should not be allowed to remain; they produce no fruit and only crowd and rob the parent stem. The confining of a plant to a single stem is of the utmost importance for the production of fruit of nearly all fruit trees, and is especially so with the fig. The trees can be trained either with high or low trunks, after once being formed; pruning then becomes less, requiring only thinning out and occasional shortening of some of the branches. The pruner has, however, great difficulty in contending against the over-luxuriance of growth of trees grown on damp soil. In such cases it is necessary that the pruner should guard against over-luxuriance, by keeping the shoots on the tree thin and well exposed to the full influence of the direct rays of the sun. The trees should also be prevented from extending beyond bounds, even if heavy cutting has to be resorted to. Where trees grow under such conditions (too luxuriantly), the young growing shoots should be vigorously pinched back through the summer, in order to check luxuriance and bring the tree into a stubby, fruitful form of growth.

#### PRODUCTION OF FRUIT.

The first crop of the fig is borne on the wood of the previous season's formation. That of the second, or succeeding crop, is produced in the axils of the leaves on the wood of the current season's growth. Frequently remnants of the last crop of fruit of the previous season are seen on the trees after the fall of the leaves in autumn; these are those which failed to arrive at maturity, perhaps through want of heat or the proper conditions required at that time. This fruit is not worth consideration; sometimes a few, under very favorable conditions, remain on the tree and ripen the season following, but this is very seldom.

#### PREPARATION OF THE FIG.

Fresh figs are toothsome fruits, but little nutritious, and sometimes rather indigestible: The dried figs are the most valuable. These are prepared either by artificial or natural heat. The experiments made during this and former years proved conclusively the fact that natural heat is the best, and produces better fruit. Before mentioning the processes in use in this State, I will briefly describe the processes in use in foreign countries; and while many, and, perhaps, most of them could not be put into practice in this State, many good ideas are derived from them.

The Tuscans dry them loose, and make loaves of the whitest and the sweetest. In the southern provinces they are strung on small canes or flexible branchlets of holm oak or of other plants.

The same mode of operation as in Tuscany is followed in the Marches, in Umbria, and in the Abruzzi, and if there be any difference, it exists only in the divers varieties of fruits used and the manner of handling and dressing them.

At Naples, as already stated, the production of dried figs is rather insignificant, owing to the great consumption of figs in the fresh state. This industry, however, begins to assume a greater importance in some parts of the province, as, for instance, in the district of Pozzuoli, concerning which the Agricultural Association reports as follows to the Ministry:

“The dried figs confected in this district are to be considered as a commercial product, both at home and abroad, but the export is very limited. The preparation of dried figs is simple. As soon as gathered the figs are dried, some peeled, some in their natural state, and others divided in halves down to the stalk; the latter are afterwards united in pairs, or else made into various shapes, such as small slabs, hearts, and the like. Those which, on account of rain or other circumstances are not in a condition to be dried in the open air, are put into ovens.

“The figs thus prepared are thin, light, and of very agreeable taste, because grown on a volcanic soil, and they command a higher price on the Naples market than the dried figs from the Calabrias and other localities.”

In the neighboring province of Salerno the production of dried figs begins to acquire a greater importance; that is to say, in some places, since in the district of Campagna, according to the Agricultural Association, the figs are not fit to be dried. On the other hand, the figs prepared in the Vallo of Lucania are esteemed, and the Agricultural Association speaks of the industry:

“The fig thrives pretty well in the southern part of the district, and particularly on lands bordering the Mediterranean Sea. Its production constitutes one of the leading articles of trade of these places, and the dried figs of Agripoli, where there is a landing at which ships take on their cargoes, are renowned abroad, especially in France and America.

“The system of desiccation is very simple. The figs are gathered when well ripe, spread over a lattice, and exposed to the action of the sun. Care is taken to turn them over alternately every two days, and subsequently the more perfect are separated from those that are less so, the first constituting the better quality and selling at a higher price, while the second are dried in an oven at a moderate temperature, and form the inferior grade, selling at a lower price.”

Where, however, the preparation of dried figs assumes really the character of an agricultural industry, being carried on on a rather large scale, is in Terra d'Otranto and in the three Calabrias, that is to say, in the provinces of Cosenza, Catanzaro, and Reggio.

The production of dried figs is of great importance in the province of Lecca, and we find, in the reports of the Chamber of Commerce of this country, that in the only two communes, that is, those of Cutrofiano and of Galatina, there was prepared, some years ago, about one million two hundred and fifty thousand pounds of this produce, and that the increasing planting of figs foreboded a sensible augmentation. But there, also, the preparation of this class of goods could be much improved; and, in fact, we read in a report by the Agricultural Association of Lecca:

“The preparation of dried figs should be still further improved by introducing among us appropriate hot air stoves to accelerate the desiccation of spotless fruit, especially in rainy summers, and when the harvest is very plentiful and of good quality, and to prevent the easy fermentation which often takes place during the natural desiccation under the

burning rays of the sun; as also in the matter of æsthetics, that is, the external appearance, since our figs may be served on the table, and are not merely used, as is sometimes the case, to make alcohol."

Three Agricultural Associations of the province of Cosenza have sent the following answers to inquiries from the Ministry on this subject:

The Agricultural Association of Cosenza: "The dried figs represent for this province a pretty important article of export trade. The preparation of these dried figs is very simple. They are dried in the sun, and then packed in small baskets made of strips of chestnut wood interwoven very closely. The method of drying, though simple, is undoubtedly uncertain, and it frequently happens that in the latter part of summer, or at the beginning of autumn, the figs cannot be dried, and spoil, owing to repeated and excessive rains; people then have to resort to the artificial heat of ovens, and the fruits prepared in such a manner fall sensibly in price."

Agricultural Association of Castrovillari: "Although the soil and climate favor the cultivation of the fig in this district, it cannot be said that the product of confected dried figs forms the object of a large trade, either at home or abroad. They are never prepared in any other way but by drying in the sun, and sometimes cooking in the oven, especially those of inferior quality, called *Fichi bruni* (dark figs), on that account."

Agricultural Association of Paola: "Some of the dried figs prepared in this district are exported, and a great quantity forwarded to the principal markets of the kingdom. The greater part of the dried figs put up for the trade are confected after desiccation in the sun. The figs are confected in various ways, being strung or made into a kind of tress, formed into small globes wrapped in fig leaves, or shaped like stars. Some are stuffed with walnuts or almonds and seasoned with thin shavings of citron peel, or cinnamon or cloves, and then put into the oven to serve as sweetmeats; or else they are dipped into honey and cooked in a copper-lined kettle or pot, being afterwards put up in varnished earthen vases. The dried figs, prepared according to the latter method, are sent as gifts to friends, and a very small quantity finds its way to the markets of the principal cities of the kingdom and of foreign countries. These figs are dried only when perfectly ripe, and care is taken to preserve them from the inclemency of the weather and from the dew, as well as from white frosts. The communes of this district which do not sell any, are: Paola, Amantea, Belvedere, Marittimo, Longobardi, San Lucido, Scalea, Cleto, Serra di Ajello, Fiumefreddo, Santa Domenica, Jalao, Maiera, Orsomarso, and Verbicaro."

As to the province of Catanzaro, we reproduce here the careful and detailed report made to the Ministry by the Agricultural Association concerning all that which relates to the dried fig industry:

"The custom of drying the fruits of the fig is very old, and almost general in the southern regions of Calabria. The output of this industry—arising probably at first as an auxiliary means to relieve the economical wants of the poor country people during winter, their produce meeting with a general welcome where, by reason of climate, the fig does not grow—advances in proportion as it is favored by the physico-geographical conditions of the soil and the special skill of the farmers. The principles which regulate its progress lie in the selection of the species, in the degree of ripeness of the respective fruits, in the time of their gathering, and in the mode of drying them. Of the

many figs—counting over twenty-four varieties in this country—the only ones found, through experience, as fit for the industry we speak of, are the Dottati and the Petrongiano—the fruits of the second crop being mostly used; that is, those growing after the *flower fruits*, from the month of August to the end of September. None of the other varieties succeed here—giving products that are soft, viscous, unsavory, and which spoil in a short time. To the choice of varieties must be added the complete maturation of the fruits, which must be effected spontaneously and without violent means. In good practice the figs are considered as having acquired the desired degree of ripeness when they hang from their stalk vertically and are wrinkled on the surface.

“The state of the atmosphere when gathering is of the utmost importance. The best time for carrying on this work is immediately after sunrise, and properly after all traces of dew have disappeared from the tree. Damp air, white frost, and rain of any intensity endanger the success of the product. Having ascertained the maturity of the fruits and the favorable concurrence of the atmospherical circumstances, the gathering is proceeded with daily, particular care being had not to tear nor strip the delicate epicarps in any way, and to pick each fruit, together with its peduncle. This done, they are at once spread horizontally over large networks of canes previously arranged like raised floors, well aired, well sunned, and protected from the dust which the wind might cast over them. The fruits successively gathered are laid over separate lattices, in order that they may be all subjected to a uniform treatment. They are turned over several times a day during the whole period of desiccation, and care is taken to separate the smaller fruits, and those of poorer grade or decayed. After twelve or fifteen days of such treatment, the figs, owing to the evaporation produced by the solar action, become white and dry externally, pulpous and sugary internally, properties which they preserve for several years, especially if not kept in fresh places and exposed to the air. In fact, arranged in baskets of the moderate capacity of thirty-three to forty-four pounds each, they withstand long journeys by land and by sea without spoiling at all. There are many here who, to advance more diligently the drying of the figs, cut them vertically into halves, and after desiccating, readjust them in their natural position, and form them, by the aid of small cane sticks, into rectangular tablets. Often there is introduced between the two parts of the fig bits of walnut or small pieces of candied citron, to make them agreeable to the palate.

“Whenever the season is rainy at the time of ripening of the figs, the desiccation is made in ovens, this being done also for the fruits that are too backward or become spoiled through any cause. These figs, although of lower grade, acquire yet an exquisite savor, and are much in demand among the poorer classes.”

There are, in Reggio di Calabria, great areas of land planted to figs, and, therefore, the production in that country and the quantity of dried fruit is great. Speaking of this industry, the Agricultural Association of the chief town of that province thus expresses itself:

“The confection of dried figs is effected in our country by gathering the fruits when perfectly ripe, and especially those of autumn, the *seconda mano*, or second crop.

“From these the largest are chosen, cut in two lengthwise, spread over large hurdles, and exposed to the sun to dry. When the figs thus

prepared appear dried, they are strung on small canes, forming tresses of various sizes, or made into squares, called *tavolieri*, or similar odd designs.

“The smaller figs are dried whole as picked, and preserved separate, they being known under the name of *cuzzoli*.”

Other notes on the same subject are furnished by the Agricultural Association of Palme, which says:

“The figs grown in this district are eaten fresh, and what little is left over are dried for winter use in well-regulated families. As a general rule, the dried figs consumed in this district come from the neighboring district of Gerace, where there are very large plantations of that sort of tree. The preparation of these figs is effected with little care. The larger ones are cut longitudinally down to the stalk, and spread confusedly over small hurdles. These are exposed to the sun, and in the mountainous regions, where the figs are late in ripening, their desiccation is completed in bake ovens.”

We have also reports from the Agricultural Association of Gerace on the importance of the production of dried figs, which is said to be a source of great profit for the district. The figs grow to perfection in that territory, but, as confessed by the association, their drying is rather defective. Generally the figs are picked when imperfectly ripe, then cut in halves and exposed to the rays of the sun over hurdles, care being taken to turn them often. After the fruits thus treated are dried, they are strung on cane strips, or else on thin green withes, and exposed anew to the sun, or to artificial heat, to complete their preparation.

The soil and climate of the greater islands, Sicily and Sardinia, are no less adapted to the culture of the fig than those of Calabria, and the production of this fruit in that part of the country is large.

The Agricultural Association of Palermo says that the best quality of dried figs produced in this province come from the communes of San Fratello and Pollina, in the Madonie. The preparation is of the simplest, and generally solar heat alone is used. “As to the preparation,” says the association just mentioned, “the figs most prized are those disposed in tablets, which last longer and are preserved better. They have also those that are cut and then arranged in pairs in form of tresses, which become mellow and preserve a greater quantity of saccharine matter. There are, lastly, the figs called *Messinesi*, or *Neri*, which are dried separately, without being cut, and, as they preserve their skin, become coriaceous, and keep longer than the others.”

For the province of Messina, we have the following notes from the same Agricultural Association:

“The dried figs of this district may be considered as a commercial product intended more for home consumption than for export. In fact, some small vessels from Trapani and Naples come into the port of Milazzo, in the month of October, to take cargoes of this produce and transport them to Trapani or to Naples. The islands of Lipari, which give the most exquisite figs of the district, send also their small production abroad. The city of Messina, on the contrary, receives dried figs from the nearest Calabria. Everything considered, however, we can reckon that the production is limited to the consumption of the inhabitants.

“The dried figs are prepared in the following manner:

“The figs are picked rather ripe; then they are cut through the mid-

dle with a knife and spread over hurdles in the sun. The fruit being dried internally, the side of the skin is turned up. When well dried the villagers perform the operation of putting the fruit *a pania*, as they commonly call it there. The *pania* is composed of the sixth part of canes cut to a point, all the figs being fixed two by two, between two of these canes; thus they form quadrangular plates about twenty inches in length, and of the width of a fig that has been opened and spread out; that is to say, about four inches. These *panie* are exposed for a few days to the sun so as to dry them still better. The harvest and desiccation being wholly completed, the farmers wash all the *panie* with fresh water and set them out in the sun for another day. All this being done, the figs are preserved for the winter in chests or pantries, or else they are sold to speculators."

Information still more precise than the preceding is given for the province of Catania by the Agricultural Association, which, in answer to queries from the Ministry on this subject, thus expresses itself:

"The cultivation of figs is rather extended in the district of Catania, and especially in all the *allogii* (freeholds) of the Etna region, where the fig is spontaneous. Many are the varieties of figs, both early and late, or backward, grown in this district, and the markets are supplied with fresh figs from the end of July to the end of December.

"The first white figs are called *Auttati*, better named *Agostani*, and the black, *Fichi melongiane*; the last are black and small, and are called *Nataline*, or *Natalinedde*, because they ripen about Christmas time.

"The fresh figs are consumed where they are produced, being as healthy a food as grapes and the opuntia (Indian fig or prickly pear). Part of the fresh fruit, however, is exported outside the province, particularly to some places in the provinces of Syracuse and Caltanissetta. Both the white and the black figs which ripen in the months of October and November are dried.

"The desiccation is done in two ways. If the fig be small, then it is dried whole with the peduncle; but if large, it is opened in two with a knife, and thus reduced it is exposed to the solar rays over hurdles, the fleshy part up. In the first case, the figs are said to be dried *a passuluni*; in the second, *a chiappa*.

"As soon as the figs are deprived of that honeyed juice which renders them rather soft, they are subjected to the following treatment: The *passuluni* are strung on thin rushes, or on twigs of *ligara*, called, also, *liami*, or else on slivers of cane, which are disposed in squares, that is, the slivers are fixed to two strips of ferula. The figs *a chiappa* are formed by the reunion of two figs, placed one above the other on the fleshy side, leaving outwardly the side of the skin. In this manner the two halves of the *chiappa* are pierced through the center by *ligara* or *rushes*, as above, and the *chiappa* are then superposed one over the other. The *passuluni* and the *chiappa*, having been united, water is set to boil; and while boiling, the figs thus prepared are immersed into it for a few minutes, in order to prevent any fermentation that might take place, and then they are put out anew in the sun to be dried again. This done, the *passuluni* squares are put away in dry places; those that are strung are rolled together spirally, and the same is practiced for the figs *a chiappa*, thus giving wheels of *passuluni* figs and of figs *a chiappa*, which are named *scerti di ficu*, and are preserved as the best.

"In some places the white figs are distinguished from the black, and

there are then white and black *passuluni*, and white and black *scerti di ficu*. Sometimes, when the figs are big and pulpous, they are dried in *scerti* stripped of their skin; then they are called *ficu senza scorcia*.

“The dried figs serve as a food to both the rich and poor, in winter and spring; they are not used later, since the dried fig is held as heating. The dried figs are also exported; thus, from Porto di Catania shipments are sent to the Calabrias, and even to Malta, from whence they are transported to still more remote countries. The dried fig industry is more extended than that of prune, and that of dried opuntia (Indian figs), which are also produced in the district of Catania.”

The production of dried figs is less important in the province of Syracuse, concerning which the Agricultural Association says:

“In this district the greater part of the figs are consumed in the natural state. What little are dried are put up expressly for local consumption. The dried figs are prepared by exposing the fruit cut in two to the action of the sun until perfectly desiccated. As soon as dried, the halves are pressed together, and the reunited figs strung one over the other on strips of canes or pointed switches; then they are plunged two or three times into boiling water, care being taken to dry them anew in the sun afterward. This operation being completed, the dried figs are offered for sale.”

As to the singular practice of immersing the figs in boiling water as soon as dried, it is explained in another report of the association aforesaid, in which we read: “They (the figs already dried) are plunged into boiling water to destroy the myriads of minute eggs deposited over them by insects, when the fruits are out in the sun.”

The same Agricultural Association adds, that in some parts of the southern provinces, and perhaps, also, in the islands of Sicily and Sardinia, the dried figs are strung on thin and sharp twigs from the *Lycium europaeum*, vulgarly *Spino santa*, or *Spino di Christo* (holy thorn; thorn of Christ), which grows spontaneously in hedges in the olive region, and in speaking of the systems in use, says:

“The marked difference in price is not due entirely to the diversity of material, but rather to carelessness and to the imperfect methods followed among us in drying the fruits, as also to the negligence brought in putting them up and giving them the final touches before offering them to the trade. The French and Spanish put up their products in such a way as to give them a nice appearance, even if the quality of these products be not of the best. Among us, on the contrary, even the products of excellent quality are most often thrust confusedly into baskets, bags, sacks, or other vulgar recipients, and seldom are they gotten up in a more decent and proper manner.

“The bad systems of preparation in this country are the causes that dried fruits, and especially the figs, which represent the greater part thereof, are called for abroad almost exclusively for distilling purposes, and to make coffee powder or other similar articles. And this will last as long as no improvement is made in the modes of desiccation, and until drying in moderately heated dry-air stoves, as is done elsewhere, be substituted for the imperfect methods followed at present. Our people trust in the power of the sun; but if it fails, the fruits ferment and sour before drying, and they at least lose their fine appearance. Then, what cannot be dried in the sun are put into ovens, which are so strongly



heated that the fruits laid therein are almost carbonized. Whatever be the mode adopted, there is usually too little attention paid to the cleanliness of the hurdles or the tables over which the fruits are spread to dry, they being left for a long time exposed to all sorts of injuries on the part of insects, and covered with so much dust as to render them black and repulsive to look upon."

Concerning the cultivation of the fig tree in Smyrna, Consul Stevens, of Smyrna, reports:

"The cultivation of fig trees in the neighborhood of Smyrna, and in the interior, is carried on to a considerable extent. With the exception of the district of Aidin, the figs are excellent while fresh, but lose their flavor when dried. The figs so well known in the United States, Germany, and Russia, are grown in the district of Aidin. When fresh, these figs are not palatable; when dried, they are delicious, and unrivaled by the product of any other locality.

"The planting of fig trees in the valley of the Meander, where are situated the fig orchards of Aidin, is performed in the following manner: Fresh branches (cuttings), about two feet in length, are cut from the tree, and planted in a field which has been previously tilled seven or eight times during the warmest months of the year. The fig cuttings must be put in the earth to the depth of about one and one half feet, and at a distance of about twenty paces one from the other. As each branch is planted, a stick of the same thickness must be put by its side to keep it straight. Three or four times yearly the field is tilled with a plow, and then it is sown with corn or barley.

"The fig tree gives fruit the seventh or eighth year of its growth, but does not attain its maximum of yield before its twelfth or fifteenth year. It thrives at a distance of fifty miles from the sea.

"The fruit, perfectly ripe and partly dried, falls from the tree by itself, and is collected by the grower and spread in the sun for several days, on an even and clean surface, until it becomes fit for the market. The figs of superior quality are those collected when perfectly ripe, and while the north wind blows. Each tree yields on an average from forty to one hundred pounds of fruit. Trees one century old usually yield from two to three hundred weight. What would seem extraordinary, is the fact that fig trees from Aidin planted in other localities never give good results; the trees grow well and become very strong, but yield fruit inferior in quality to the commonest local variety.

"The dried figs, packed in hempen bags of a capacity of two and one fourth hundred weight, are conveyed to Smyrna by rail and carried to the fig market, where packers and export merchants get their supplies. The fruit intended to be put up for export trade is carried to the packing establishment, where it is sorted into different qualities. It is then handed to workmen, who press it between their thumb and forefinger to soften and flatten it, and pack it in rows into small, shallow, wooden boxes or small drums. Packers in manipulating figs keep their hands wet with sea water, as it is claimed that brine hastens the sugaring of the fruit. Occasionally laurel leaves are placed between the rows of figs in order to improve their flavor and keep them free from moths. Figs of inferior quality are packed in wicker baskets or small hempen bags.

"In the transportation of fruits of all kinds from the plantations to Smyrna, or to the stations on the lines of railway leading to Smyrna,

camels are employed to good advantage, the highways not being in a condition to permit of the use of drags."

Consul Marston, of Malaga, Spain, reports that the process used in Spain consists in picking the figs when they are entirely ripe, and are cured by laying them on the ground upon straw until they are cured by the sun. They are covered each night to protect them from the night dampness.

Throughout France the fig tree is common; about Marseilles it is not an object of special culture. There they cull the fruit one by one, when perfectly ripe, with great care, to prevent them from bruising or severing the fruit from the peduncle. They are then laid on hurdles and exposed to the sun, and turned over every now and then until perfectly dried; that is, for a period of ten or fifteen days, as they claim that the least exposure to moisture would turn the figs black and reduce their value by at least one half. These hurdles are taken in every evening, to be again taken out every morning. The difficulties of the operation deter most of the farmers there from undertaking it, excepting those that own small farms, where everything must be turned to account, and they cultivate them themselves with no other help than that of their families. The Marseillaise is considered there as the best variety.

Consul Heap reports that the process of curing the fruit throughout Turkey consists of picking the figs when ripe and spreading them out to dry in the sun, the sugar which they contain in abundance being thus rendered available for their preservation, those of better quality being much pulled and extended by hand during the process. Thus prepared, the fruit is packed closely in barrels, rush baskets, or wooden boxes, for commerce.

Figs are grown largely in the province of Turkey, but the quantity is small compared with Smyrna. A considerable quantity of inferior kinds of figs find their way to the Austrian "chicory coffee makers" and the French brandy distillers. Much liquor labeled "fine champagne," "cognac," etc., owes its origin to refuse of the Smyrna fig market.

Consul Fottion, of Mytilene, reports "that the kinds of figs producing the figs of commerce there are the *Politika* and the *Asprokougouzza*, so called, *Politika* from Constantinople, and *Asprokougouzza* from their white seeds." These varieties there do not require any cultivation. The figs are dried in the sun, and afterwards are filled with almonds, pepper, and cinnamon, and are roasted on plates in ovens. Aromatic leaves of laurel are added to them, and they are then packed in boxes.

In Syria the process of curing consists in opening the fruit, either by hand or cutting them with a knife, and spreading them for three days in the sun, on dry ground or on a straw mat placed on the housetops. When dried they are placed in palm leaf bags and pressed as much as possible. The figs are not gathered until they are fully ripe.

In Aleppo the figs are gathered and spread on mats in the shade until they get dried, and are then placed in bags and pressed. The best are selected, and when dried are steamed to make them fresh, after which they are pressed between the fingers and flattened, and are strung on flaxen threads to be exposed for sale.

In Damascus the figs are dried in the sun, and are then cured by covering them with flour.

In Tripoli (Straits Settlement) the figs are gathered when fully ripe,

and after breaking the fruit a little at the top they are exposed to the sun until they become dried, and are then boiled with fragrant herbs, and stored for the winter.

In Central America the figs are gathered, after having fallen to the ground the previous day, and laid in the sun (on mats made of reeds) until dried, which takes four or five days. They are then put in closed boxes to sweat a little. Before packing they are spread in the sun just long enough to get warm, and are then pressed in seroons of rawhide. They do not pack in boxes, because they claim that the fruit gets worm eaten.

In Spain they cure the figs by gathering them when perfectly ripe and when they commence to dry on the trees. They are then placed upon lattice work made of canes, or slips of boards, or on rough straw mats placed on the ground, allowing, if possible, the air to circulate under them. The figs in a few days, when dried, are pressed one by one into shape, to facilitate their curing. When cured, and lastly, the figs are pressed downwards on a table to give them a round shape; then they are packed in boxes lined with paper.

#### CALIFORNIA METHODS.

I have carried on very extensive experiments in curing or processing the fig for the purpose of determining the best method among those now in use in this State, as well as many which are published as emanating from foreign countries, and supposed to be the true processes in use there. Through the aid of American consulates I obtained the foreign processes herein mentioned, as reported by the various associations. While these processes are not such as can be put into use in this State, conditions being so different, yet they have been the means by which our experiments have been furthered.

I procured fruit from many districts throughout the State and submitted it to nearly all the foreign processes, and in almost every instance they proved unsatisfactory; no doubt due to different conditions, climate, soil, etc.

During the past few years we have accomplished a great deal in experimenting, and have been able to process fruit that is considered the best in any market. This is true not only of the fig, but also of other fruits, and they are to-day selling far in advance of the foreign article.

The process in itself should be simple, and one that can be followed by growers, and also must be inexpensive. Of all the experiments made there were but two that I feel warranted in recommending, as they are simple and inexpensive, and such as can be put into use by the ordinary fruit grower.

Figs, as a rule, do not stand as much sulphuring as other fruits, and require the most careful attention. They cannot be transported any considerable distance to be processed, as they sour in transit, and then cannot be used at all. The only way that I find figs can be transported safely is by subjecting them as soon as picked to sulphur fumes. This stops fermentation, and after the figs have been exposed to the sun for half an hour or an hour, they can be packed and shipped to their destination; but the packages should not be large, as the heat generated in bulk would again start fermentation, which even reëxposure to the sun

would not check. It is not necessary to sulphur figs more than ten or fifteen minutes. As stated before, they will not stand as much sulphuring as other fruits.

Figs grown on low, moist lands which are not suitable for fig culture, change their characteristics, so much so as to deceive some of the best experts in fig culture. Those grown on soil of a higher altitude and under most favorable conditions also change, and this has caused many to believe that they have produced something new, and to give the supposed novelty a name of their own. This has greatly added to the already much confused nomenclature of the fig. The figs grown on low, wet lands, and in low lands in the valleys, I find to have a much thicker skin, a larger cavity, and while the fruit is much larger, it contains a superabundance of moisture, which, after being picked, if the fruit is not properly treated, becomes sour; while those grown on lands suitable for fig culture and of higher altitude, possess much better keeping qualities, contain much more saccharine matter, remain more moist without souring, and in every respect are much better figs. In drying, these show about as follows: The figs grown on low, wet lands become coarse, with less pulp and much tougher skin; those grown in a higher altitude, and on valley lands suitable for fig culture, are generally not as large, but the grain is much finer, the skin much thinner, the fruit contains much more saccharine matter, and when dried does not resemble the fig of the same variety grown under unfavorable conditions, on low, wet lands, excepting in some of its botanical characteristics. Those grown on low, wet lands are generally lacking in flavor and are unpalatable, and appear in many instances as if part of the inside had been squeezed out; while those grown under better conditions are very fleshy, so much so that when pressed they burst out at the end; while the former in being pressed show but little inside and the skin seldom bursts.

There is such a confusion in the nomenclature of the fig, that for the present I shall not mention any variety but the White Adriatic (Cal.), this being to-day the best fig in California, as far as we know, for drying.

During the past few years a great many fig trees and cuttings of many varieties have been imported into this State. After they began fruiting, nurserymen and others, having become confused as to their origin or names, at once rechristened them, giving them popular names. In one instance I found the fig known, within a radius of a few miles, under at least seven different names, and no nurseryman had taken the pains to investigate its true name. I also found, upon investigation, that the same confusion existed abroad. The Minister of Agriculture for Italy found this same difficulty, and was unable, in his own province, to identify more than three varieties, yet, in that same district, more than one hundred varieties had been previously described by nurserymen and others.

The same confusion was found in the names of the fig tree and cuttings imported from France. Trees were once received from a district in France under certain names, and from that same district trees were received under entirely different names. Those varieties most prominent, however, although not more than a dozen, could be traced by following the California popular names that had been given them, but this would hardly be of any use, except for identification.

Conditions in this State are so varied that, as I have stated before,

figs grown in different localities change their characteristics so much as to prevent identification, unless by an expert in that line. In one of the valleys I found the White Adriatic (Cal.) grown under, what seemed to me, perfect conditions. The fruit was the largest of that variety that I had ever seen, but the color differed so much that not until I made a critical examination did I become convinced that it was the White Adriatic. The seams on the surface had opened very wide, and instead of the fruit possessing a light, yellowish green tint on its surface, it was as green as the leaves themselves. There had been several boxes of figs picked that were dead ripe—that is, they had wilted on the trees—yet among those boxes not a fig was found to contain any yellowish color whatever; everything was of a deep green color, yet all the figs were dead ripe. This, however, was a singular thing, and nowhere else had I ever seen this strange occurrence. Possibly it may have been due to certain climatic influences, or the forcing by irrigation; when such figs are processed they do not become as nice as those which assume a yellowish tint, unless subjected to strong sulphur fumes, which generally deteriorates the quality of the fruit.

In the coast counties the fig ripens much later than in the interior valleys, generally commencing to ripen when those in the interior valleys are nearly or about gone.

The following are the two processes which I think can be put to use by the fruit grower, and such as make good and marketable fruit. The greatest care must be taken in the preparation of the fig, as any neglect will cause the loss of a great deal of fruit.

*First Process.*—The figs are allowed to shrivel on the trees, then they are picked and placed on trays, bloom end down. The trays used are made of slats to allow ventilation from the bottom. The fruit is generally cut with a sharp knife or shears, but a man, after having worked awhile, can pick the figs without the aid of a knife or shears, by a simple twist of the fingers. The trays, having been filled, are placed in the smoke house. These smoke houses should not be too large, and neither should the trays, for it is difficult to handle such heavy fruit, and this also prevents bruising. After the trays have been placed in the smoke house the door is shut, and the sulphur lighted and allowed to burn. The greatest care must be taken in the amount of sulphur that is burned, for if too much is used the figs will have a smoky taste, and the figs will become bleached; if not enough is burned, the sulphur cannot act on the figs, and when dried will not possess that light color so much desired, but will retain part of the greenish tint, especially the part that rested on the trays. The sulphur should be burned at least two feet below the lower tray to prevent any from depositing on the fruit.

There is great diversity of opinion as to the length of time the fruit should be left in the sulphur box, or smoke house, and also as to how long the mass of sulphur ignited under it, which produces the fumes, should remain burning.

Fruit cannot be well sulphured or fumed in less than ten or fifteen minutes from the time it is placed in the box, as at least ten minutes are required for a mass of sulphur to generate enough fumes or smoke to entirely fill every space of the smoke house. However, after the box or house is filled with fumes, five to ten minutes longer should be enough time for the fumes to accomplish their effect; it could do no further good if the fruit should be allowed to remain a longer time. The object, there-

fore, in leaving the fruit in the sulphur house a longer time is for the purpose of allowing it to undergo an artificial sweat to reduce the skin, which is done by the heat generated by the inclosed fumes. This is a great advantage, for after the fruit has gone through this artificial sweat and been placed in the sun, the skin is reduced to a minimum, and the fruit turned somewhat transparent.

The sulphur must not be burned too near the fruit, as considerable pure sulphur is liberated, and the bottoms of the trays being open, considerable fruit would be damaged by coming in contact with the liberated sulphur. The fruit on the lower tray, instead of bleaching out white, will become of a pinkish color, and will not dry. Such fruit generally remains in the sun puffed up, seemingly full of air. The reason for this is that the fumes of the sulphur are heavy, and take with them considerable pure sulphur, which is liberated and is deposited on the fruit.

It is impossible to determine the exact amount of sulphur to be used. After the room is well filled with smoke, which can be seen through the trap-door, it is about time to withdraw the sulphur-pan. The smoke or fumes are not allowed to escape, but the fruit is allowed to remain, with closed doors, till it is taken out and placed in the sun, and should not remain more than twenty minutes.

I find it best to pick the fruit in the morning, for after it has been placed in the smoke house and once been subjected to the sulphur fumes, it may be placed in the sun, where it bleaches out beautifully, much better than it would later in the afternoon, as the hot rays of the sun are an advantage. The fruit picked and sulphured in the afternoon, by the time it is placed in the sun, the sun will be so weak that the fruit will not bleach out as well. Those placed out in the morning make a much better fruit—pliable, soft, and the skin is reduced considerably. After the fruit has been exposed to the sun for an hour, it is turned over by hand. This is done to allow the part resting on the trays to also become bleached, as that part will retain its original color if not turned over.

After the fruit has been out two or three days it is time to handle it; that is, the fruit can be rolled between the fingers, which is called, in many instances, "finger pulling" or "rolling." This is done to prevent the figs getting hard in drying. The operation can be performed every day if the operator so chooses, but it is not necessary unless the figs have dried considerably. After the figs have been out at least four days, have dried away considerably, and have been turned over and rolled between the fingers from time to time, as above stated, they can be removed from the sun and placed in the shade. This prevents the fruit from getting hard.

After all signs of moisture on the surface have disappeared the fruit is placed in wire baskets and dipped into boiling water, the hotter the better. This dipping closes up the pores, kills all germs, and again reduces the skin somewhat, and gives the fruit a beautiful color. It is only necessary to dip the fruit into the water and raise it up immediately two or three times. If allowed to remain too long in the water it will be rendered sour, and a great deal of the true fig flavor will thus be lost, which must then be substituted by other means or the article will be inferior.

After the dipping the water is allowed to entirely drain off from the figs, and they are then thrown into a pile, either on a clean wooden floor

or table, or bins, and from time to time are shoved backwards and forwards until they become cold. When the moisture has entirely evaporated it is then time to pack them.

It will be observed that in processing figs in this way there will be two or three grades of fruit, at least two; the first of the light pinkish color, and the second a much darker color. They should then be assorted, and the grades packed separately. The reason for this variation in color is the unevenness in the drying of the figs on the tree. Generally in picking it is impossible to have the fruit of about the same degree of ripeness. That which has shriveled considerably will not become as light in color as the fruit that is less shriveled; in fact, the fruit that has not shriveled at all becomes the best color. The culls are assorted, and the best fruit put into boxes in layers, not artistically arranged, but simply thrown in, and between the layers fine white granulated sugar is dusted, and then the boxes put under heavy pressure. The sugar serves to cover up many defects in the fruit. These, after being packed a few weeks, become a good marketable article, which, of course, does not bring as much as the two grades above mentioned. The fruit that cannot be used in packing, that is, the discarded culls, is placed in barrels or sacks, and can be sold as hog feed, and for the purpose of making vinegar, to which purpose they are well suited.

*Second Process.*—The fruit is picked from the tree when it has shriveled considerably, and is placed on trays without sulphuring. The trays are made of slats, and placed on staging, which should be sufficiently high from the ground to allow a free circulation of air beneath the trays. It is best to place the bloom end of the fruit towards the rising sun, as that part requires more heat than the stem end. After the bloom end has dried, the stem end, containing very little moisture, will dry with less heat. This, however, can be done without much handling, as the figs, having been set all one way, and as the sun in the afternoon changes to the west side, the tray is simply turned around instead of the fruit. This brings the end of the fruit in direct contact with the sun during the hours of drying. After the fruit has been out two or three days “finger pulling” or “rolling” begins. The figs are rolled between the fingers, and turned over on the trays. This operation can be performed as much as the operator pleases without injury to the fruit.

After the fruit is dried it is placed in boxes in the storehouse; the boxes need not be filled to the top, and can be piled one on another. They are kept in these boxes for at least six or eight days, to allow them to undergo a natural sweat. Every day, however, they are emptied from one box into another, to allow the part resting on the bottom to come to the surface; in this way they never become moldy.

After the moisture among the figs has disappeared, they are ready for packing. They can then be assorted into as many grades as the operator chooses; however, it is unnecessary to pack more than three grades, and seldom more than two.

Before packing, the figs are dipped into a solution of hot water containing a little glycerine or glucose. This will serve to give the fruit a gloss which it does not possess before dipping. Bay leaves are placed amongst the figs in packing in the boxes, which serve to give the fruit an attractive appearance. It is claimed that they keep away insects, but such is not the case.

*Use of Sulphur.*—Sulphur is used, and the process properly should be

called "bleaching," as it bleaches the fruit. It is only the outer surface of the fruit that is exposed to the sulphurous fumes. These fumes destroy any germs that are attached to it, or produced right on the fruit.

The chemical action of the sulphur fumes is to bleach the fruit on the exterior surface; it does not enter the interior surface, as the fig, whether or not it be opened at the bloom end, is generally full of air, which prevents the sulphur fumes from entering, and even if they found entrance no damage would be done. The sulphur fumes determine the color of the dried fruits, and sulphur is used simply to stop discoloration of the outside and brighten the fruit.

The common method of burning sulphur under fruit and leaving it burn for a considerable length of time, to render the fruit transparent and of a light color, rather tends to detract from its true flavor than to add to its quality. Fruit should only be confined in sulphur fumes with the objects above stated. Figs are not cooked for eating, and differ in this respect from other fruits; therefore, the process should be one to retain that flavor so essential in a marketable article for consumption in a raw state.

The best method I know of for generating sulphur fumes, in the least time, consists in placing a heavy one and one half or two-inch iron plate on a small kerosene stove in the smoke house. When this iron plate becomes hot, but not so hot as to cause the sulphur to flame, the fire is extinguished, and the sulphur is spread on the plate. As soon as the sulphur comes in contact with the plate a dense smoke is liberated, which fills the smoke house in a few minutes, and in much less time than when ignited. It has also the advantage that gases and sulphur are not liberated and deposited on the fruit as when allowed to burn.

#### FOREIGN VARIETIES.

In the report of the Minister of Agriculture of Italy, for 1886, the following very interesting account appears concerning varieties:

We have the *Fico gentile* and the *Fico portoghese*, both precocious. The first is common, under the indicated name, in the Neapolitan district, in the province of Rome, and in the Tuscan province, in some parts of which, as at Pistoia, Lucca, and in Lunigiana, it is known under the name of *Fico d'oro* (golden fig). According to some, this fig, the earliest of all, would be the *Tiburtinus* of Pliny, or at least an analogous variety. The *Fico portoghese* is very common in the Florentine country, and does not seem to have issued from Tuscany, as it is not found in Liguria, nor in Milanese, nor in Umbria, nor in Romagna, nor in the neighborhood of Rome. It is uncertain whether it be cultivated in the southern provinces or in the islands.

The following varieties are backward and uniferous (yielding only one crop yearly): The *Verdini*, very common in Tuscany, and different from the *Verdini* of the Veronese and from the *Verdecci* of the Bolognese; the *Brogiotti neri* (black September figs), universally appreciated throughout Italy; the *Brogiotti bianchi* (white September figs) of Liguria, which some people esteem nearly as much as the delicious figs which come from Smyrna in the dried state; the *Fichi brianzosi*, native of Brianza, and much cultivated in Milanese, and finally, the *Datteri* (date) and the *Dottati*, the latter of which is deemed one of the most



exquisite varieties. It appears that the *Dottati* figs of the Tuscans, *Ottato* of the Neapolitans, does not differ from the one which Pliny says was brought by Lucius Vitellius from Soria to his villa at Alba, and which corresponds to the *Grascello* of Mattioli, to the *Binellone* of Spezia and of Chiavari, to the *Binello* or *Fico di Napoli* (Naples fig) of the Genoese, to the *Gentile* of Voltri, to the *Neapolitano* of Finale, to the *Datterese* or the *Calabria* of the remaining western Liguria, and lastly, to the fig *Della goccia* or *Della goccia d'oro* of the hills of the Lombardic Apennines from Voghera to Bologna.

The demand for Tuscan figs is very small, and for this reason they are mostly reduced into powder to make coffee, as is practiced in some parts of Germany. The variety used in the preparation of dried figs is called *Dottati*, which they peel (after that they are said *mondi*, clean) and dry in the sun, then season with a few grains of anise seed, and finally dispose in disks or loaves more or less large, resembling cheese in shape. These figs, besides their very sweet and delicate flavor, preserve a whiteness rarely seen in even the best figs imported from Smyrna or other places in Greece and European Turkey. At other times these same *Dottati* figs are not stripped of their skin, but they are cut in halves and seasoned with anise or fennel seed, and then united again two by two, or, as the Tuscans say, *a piccic*, or else they are dried, strung on thin branchlets of genet or osier (willow). The black-skinned figs are more common, and they are neither sliced nor seasoned, but they are dried in the sun; and if this is not sufficient they are put into ovens immediately after the confection of the loaf.

*Elemé*\* is not a variety, as many have been led to suppose. It denotes the method of preparation. Figs called *Elemé* are those selected of extra large size and fine appearance, and, as such, command higher prices.

Among the biferous varieties may be mentioned the *Fico albo* (white fig), very abundant in Tuscany, and grown also, but under various names, in the territory of Como, in Vogherese, in Piacentino, in Bologna, in Modena, and in Parmigiano; the *San Piero* fig of the Tuscans, which is the *Fico arbicone* of the Genoese, the *Nero* of the Sardinians, *Minna di shiario* of the Sicilians, and the *Fallogiana* or *Pitilonga* of the Abruzzese. Beyond the Apennines this fig does not seem to spread much, and, indeed, it is not known by either the Lombards or the Piedmontese.

#### THE FIG IN CALIFORNIA.

While a great deal of attention has been given to the fig in this State, it has so far been largely in the line of experimenting, and dried figs have not as yet been produced in any great commercial quantities.

\* *Elemé*, a name given to Smyrna raisins; the best quality are known as "*Elemé*." Raisins of a somewhat inferior quality are known as "*Lexias*." (Enc. Brit., Vol. XX, p. 258.)

*Elemi*, a resin, thus termed in modern pharmacy, obtained by incising the trunk of a species of *Canarium*, found in the Philippine Islands, used chiefly in the manufacture of spirit and turpentine varnishes. The word "*elemi*," like the older term "*animi*," appears to have been derived from *enhaemon* (Greek), the name of a styptic medicine, said by Pliny to contain tears exuded by the olive tree of Arabia. This tree, according to Pluckiger and Hanbury, is probably to be identified with the *Boswellia Frereana*, or birdwood, which flourishes in the neighborhood of Bunder Marayah, west of Cape Guardafui. Mexican or Vera Cruz *elemi*, formerly imported into England, is afforded by the species *Amyris elemifera*, Royle; Mauritius *elemi* by another tree, *Colophonia Mauritianana*, and Brazilian *elemi* by several species of *Icica*. (Enc. Brit., Vol. VIII, p. 122.)

Enough, however, has been done to show that California may hope ere long to include her fig products with those of her citrus fruits, prunes, and raisins, among the leading industries of the State. A prominent commission merchant of San Francisco, who handles a large amount of our domestic dried fruits, in speaking of the California figs, says:

"I think the outlook for the fig industry in California is very bright. The producers and packers have made great progress in the last few years in the cultivation and curing of this grand fruit, but for some reason they have either failed to discover the right variety of fig for the soil and climate of this State, or they have not yet attained the proper perfection in the process of drying. I am unable to say definitely where the fault lies, but am inclined to think that it is in the variety. There is no reason why California should not raise as good figs as any country in the world. In my opinion she has no superior in the production of olives and nuts, and I am confident that when we overcome the slight difficulties that now confront us, the fig industry will grow to great proportions.

"There is room for wide development right here in the local market, to say nothing about the territory beyond the Rockies. This is shown by the fact that there are imported into this market not less than one hundred tons of dried figs every year. What the producers must do is to supply a product that will take the place of the imported article. I am entirely confident that they will be able to do so, for I have seen California figs, particularly at the Marysville Citrus Fair, that were as fine in texture, color, and saccharine quality as any that can be grown on the globe. For all these reasons I regard the outlook for the fig industry as highly encouraging."

With regard to the quality of California figs, Consul Emmett wrote from Smyrna:

"A box of figs grown and packed in California reached here this autumn, and was inspected and universally praised by many dealers. In some instances it was impossible to persuade the parties that said figs were grown outside the Aidin district; in fact, some went so far as to designate the orchard. Those who grasped the full importance of this American enterprise predicted that Turkey's supremacy in the fig trade was waning. Some console themselves with the opinion that the American fig will not continue to be good; as the trees (grown from Smyrna cuttings) grow older the fruit will have thick skins and become tough; in fact, become native American figs."

The fig was introduced into California, with its companions, the olive and the vine, by the Mission Fathers. From whence the original stock came it is now difficult to determine, as a distinct variety of each has been developed in California, to which the name of Mission has been applied. The Mission fig is one of the best for all purposes grown in the State. In color it is black or dark purple, and this militates against it in the market as a dried fig. This is mere sentiment and simply because the most generally and best known to commerce—the Smyrna—is white or light colored. The Mission, rightly dried, is superior to all except the genuine Smyrna, and is, by many, thought to equal that. The tree is among the hardiest, strongest growers, healthy, and the most productive of all the fig varieties, and adapted to a wide range of soils. It can be grown nearly everywhere on this coast where the winters are not too severe. In the rich, warm interior valleys the tree grows very

fast and to a great size, and ripens two or three immense crops each season. It is suited to a great number of economical uses, and not as yet properly appreciated and utilized as it should and will be. It is a rich, nutritious fruit for man, beast, or fowl. Crops are as regular as the seasons.

The fig does best in this State back from the coast, and some of the best results in its cultivation have been secured in the Sierra foothills. Some very excellent figs have been produced in Fresno and Tulare Counties, while some of the best drying fruit in the State is grown in Placer, San Bernardino, Solano, and Ventura Counties. At Downey, in Los Angeles County, is a very large fig orchard, devoted to the Marsel-laise fig, a small, white, sweet fruit. Some of these trees are sixteen years old and bear quite heavily. These figs are disposed of in Los Angeles, where there is a good demand for this fruit for crystallizing and glace purposes. Growers receive \$50 per ton for this purpose.

George C. Roeding, of Fresno, in a paper read before the Fruit Growers' Convention at Marysville, gives the history of the introduction of the Smyrna fig in this State, as follows:

"Among those who have taken a lively interest in this country in the fig business, I may say that the Fancher Creek Nursery has done a considerable share by importing and planting numerous varieties of cuttings from Smyrna and other places, and it is only during the last two years that any practical results have followed its exertions.

"With the introduction of the White Adriatic variety it was thought the problem had been solved; and while it cannot be denied that this kind produces one of the finest of table fruits, it must, at the same time, be admitted that when dried it does not come up to the standard of the imported fig from Smyrna, lacking in its most essential points, viz.: tenderness of skin and the flavor.

"The early conviction of this truth induced the proprietor of the above nursery to send his foreman, in the year 1886, to Smyrna for the purpose of investigating the fig business on the spot and obtain a variety of cuttings and all possible information for the successful prosecution of the business in this State. He remained in Smyrna four months, and, after considerable difficulty, succeeded in securing several thousand of the Smyrna fig cuttings, as well as quite a number of wild figs and a few of such varieties as are grown for home consumption, some being used in the green state, others dried. His trip and experience will probably be of interest, and the following is a copy of his letter of November 6, 1886:

"I am having no end of trouble. I find that I have been watched by the people here since first landing. The parties from whom I first engaged cuttings have refused to let me have any at any price, and I do not know what to do. I went to the American Consul for assistance. He informed me that I could only obtain the cuttings through a foreign resident, as the Smyrna people were much opposed to sending cuttings of any kind out of the country, for fear of competition. Seeing the utter uselessness of trying to secure the cuttings directly, I took out a hunting license, and, with a passport which I had used on a former trip, I, with Mr. Hall, a gentleman who had resided a number of years in Smyrna, started for the interior, and was successful in getting cuttings from Erbold (this is the valley where the finest figs are grown). I did not appear in the transaction at all, but was shooting in the orchard where the cuttings were being gathered, and kept watch of the Turks all the time, to see that the cuttings were cut from the right trees. From the valley I shipped them by the Aidin Railroad to Smyrna as licorice roots, the company refusing to take them unless consigned in this manner. On the arrival at their destination the packages were placed in the warehouse of the English Steamship Company, and there packed with sawdust, in boxes lined with thick paper, and shipped on a steamer bound for London.

"With the assistance of Mr. Van Lennip I secured the wild fig cuttings, and also quite a number of other varieties.

“After this gentleman’s departure, the following appeared in the ‘Oriental Advertiser,’ published in Constantinople, of December, 1886, from their Smyrna correspondent:

“We often hear people exclaim, ‘I don’t care a fig,’ as if they considered a fig a very small matter. Our American cousins, however, look at it from a different point; that is to say, from a commercial point of view.

“We always thought the fig growers of Asia Minor were jealous of any foreign competition, and we gave them credit for a certain amount of worldly foresight and wisdom; but we find that it requires but little of the gold dust of the New World to blind them to their own interests. The Americans have just succeeded in playing upon the dozing Smyrnaites a trick, which, no doubt, will prove of serious consequence.

“Some three weeks ago W. C. West, of the Fancher Creek Nursery, Fresno, came to Smyrna to make a study of the Smyrna fig, and also secure cuttings of that variety for propagation in California. Fortunately for his object, Mr. West, on his arrival, made the acquaintance of an Englishman, a resident of over twenty years, without whose assistance he could scarcely have succeeded.

“This resident, by his energy and determination, brought the affair to a successful termination. Besides the figs he took cuttings of other plants. This little incident serves to show that the Smyrnaites ought not to be so indifferent to such important matters. By this time Mr. West is on his way home with his cuttings, and for the sake of the Smyrna trade it is to be hoped that the fig will not take in California, though the chance is very slight.

“If it does, however, America will supply the European market with better ‘Elemé’ than Smyrna ever produced. Another matter, which should not be forgotten, is that American machinery will, no doubt, take the place of manual labor in packing. The prospect of losing the fig trade is a sad one, and should provide food for reflection for all who live by its product in Asia Minor.

[“We do not quite agree with our correspondent, for Smyrna-grown figs, pomegranates, etc., will never be anything else, namely, the best in the world. Seeds and cuttings may be taken to America or elsewhere, but a foreign soil will never be able to give the same nourishment and strength to the new product so that no difference would be known between it and the old. At the same time our correspondent is, no doubt, right about the want of precaution on the part of those who run a great risk in jeopardizing the Smyrna fig trade.—Ed. ‘Oriental Advertiser.’]

“After a journey of seven months the cuttings arrived in Fresno May 24th, in good condition. Much to my surprise, most of them had sent out numerous roots into the sawdust, which was still in a moist condition, having, no doubt, absorbed moisture during the transit across the Atlantic.

“On account of the lateness of the season, not more than about one third of the cuttings grew, the warm weather having already commenced. They were planted out in the orchard of the Fancher Creek Nursery the following year, where the trees are now growing vigorously in light, sandy, and well-drained soil.”

That there is an ample market for our domestic fig production is shown from the fact that the United States is a large importer of the foreign article. In 1889 our importations were 9,101,300 pounds, and in 1890, 9,678,315 pounds, for which nearly a million dollars annually were sent away. This sum might as well be diverted into the pockets of California orchardists. It is estimated that the output of this State, in 1887, was about 90,000 pounds, and this amount has been increased until at the present time the product will amount to about 500,000 pounds. A great advantage offered to California producers is found in the fact that we have practically no competition in the Eastern market. The domestic product can be placed in the New York market a month or six weeks before the Asiatic crop can be placed, thus giving California an opportunity to dispose of her product before the Asiatic supply is received.

With the same energy that has been displayed by California in persistent experimenting with raisins and prunes, it cannot be questioned

but that California will produce as fine figs as any in the world. If the Smyrna will not give us this, we may yet hope for a California variety that will equal it. The industry is, as yet, a comparatively new one, the first carload of dried figs shipped to the East having been sent from Fresno, in 1889, and these sold at good figures. With this introduction, and persistent work, there can be no question but that in a few years California figs will take their stand side by side with California prunes and figs in the markets of the Eastern States.

The question of caprification, which is at present attracting so much attention, has been most ably expounded by Professor Gasparini, referred to elsewhere, and the following is a translation from the Italian of his essay:

ON THE CAPRIFICATION OF THE FIG.

[The Royal Academy of Sciences of Naples proposed as the subject of an essay:

1. To examine the opinions of authors on caprification, above all, those of Cavolina and Gallesio, and to see what were the merits of the ideas and experiments of these men.

2. To describe the varieties of figs, especially those on which caprification is practiced.

3. To prove by experiment, or on anatomical or physiological grounds, whether the fertilization of the seeds is affected by the insect of the caprifig, or whether the insect produces no such effect and caprification be useless.

4. The essay to be accompanied by figures representing the varieties of fig on which the experiments are made, and the structure of their organs of fecundation and fructification.

Gasparini's memoir in reply is divided into four parts. The first contains a detailed physiological account of the caprifig and its different varieties, which he considers not only specifically but generically distinct from the cultivated fig, including a detailed history of the fly bred in its fruits.

The second is a similar account of eatable figs cultivated about Naples.

The third (here translated) relates specially to caprification.

The fourth is a botanical comparison of the fig, the caprifig, and some exotic species.—B. M. L.]

1. *Historical Notes on the Subject.*—Herodotus informs us in his histories that the Babylonians knew of old that there were male and female date trees, and that the female required the concurrence of the male to become fertile. This fact was also known to the Egyptians, to the Phœnicians, and to other nations of Asia and Africa. The ancients were acquainted, moreover, with several circumstances proved by experience relative to the diversity of sexes in plants, like the one just mentioned of the date tree, and among these dioecious plants they distinguished the female as being the one that bore fruit. And in other cases where they suspected a diversity of sexes, not having any fixed rule or sufficient science to guide them, they judged merely by external *facies*, by medicinal virtues, or by other such fallacious or slight indications. If it may not indeed at all times have been universally believed that all things endowed with senses or life are reproduced by the concurrence of sexes, yet the ancients, although they could not detect either the

sexual organs of plants or the fact of their fecundation, nevertheless seeing them at certain periods of their life clothed with elegant flowers, perfumed with various essences, distilling delicious nectars, all radiant with glory, as if prepared for some ceremony of proportionate importance, they judged by the rules of common sense and analogy that this was the period of their loves, and that there must be amongst them all, according to the laws of nature, a male and a female. Thus, with regard to the date tree, the Babylonians, either imagining or finding by experience that the great distance of the male was often an impediment to the fecundity of the female, they suspended to the latter male flowers brought from a distance; and they believed that the fertilizing power of these male flowers resided in the small flies which they harbored, and which, introducing themselves into the female flowers, caused them to set and to ripen. This operation, called *palmification*, is still in use, and reckoned necessary for obtaining fruit in the country where the date tree grows naturally. If we could establish with certainty that this theory of the date tree was current before the facts were known concerning the fig, we might well suppose that the earliest Greek cultivators, seeing the caprifig always sterile (in so far as that the fruit does not become sweet), with a coarse and wild habit, and seeing the quantity of little flies it produces, should have thought that that was indeed the male, and that the fertility of the real fig depended upon it, and that thus taking example from the date tree the custom should have originated of suspending the flowers of the caprifig to the domestic fig tree. But the memory of this custom is even more ancient than that of the palmification of the date tree. This *caprifigation*, as it is called by us, is spoken of by the most ancient Greek writers on natural history; it is alluded to by Aristotle, and minutely described by Theophrastus, writers who were not only superior to all others in their philosophical speculations, but were very ingenious in their ideas on natural objects and phenomena.

Aristotle observes that a certain insect is generated in the flowers of the caprifig, which, having become a fly, enters the unripe fruits of the domestic fig and causes them to set, for which reason cultivators always plant the one by the side of the other, or suspend the fruits of the one to the branches of the other. Theophrastus does not confine himself to this bare statement of the practice which prevailed, but discourses at length on the manner in which the little fly could produce this effect, whether by opening or by closing the aperture of the fig. He rejects the second theory and pronounces for the first, saying that the fly by continual nibbling enlarges the mouth of the fig and sucks out the superfluous humors, and that the air penetrating through the aperture, it follows that by its warmth and fermenting qualities the fig sets and ripens. Nevertheless there are races of domestic figs which do not require the aid of the caprifig to ripen, and treating of these, this diligent observer is of opinion that this may arise from the quality of the soil or of climate as well as from the particular nature of certain figs which can ripen their fruits without assistance. He believes that a poor dry soil with a northern aspect, the deficiency of moisture in such soil, the cool wind which is usual in such a situation, and even the dust which would cover the fruit and absorb its superfluous humors, would all tend to open the mouth of the fig and produce the same effects which in the other case are brought about by the flies, and that if in Italy and

some other countries caprification was not known, it was because, for the above reasons, the figs in those countries set and ripened naturally; and Pliny, speaking of this subject, says that the caprifig is of a wild nature, and does not ripen its fruit, but that it imparts to the fig that virtue which it does not itself possess, for such is the course of nature, that even from putrefaction something should be generated. It produces midges, which, deprived of any nourishment from their own parent, fly to the allied fig, and by continual biting at the mouth enlarge it, and, penetrating within, facilitate the admission of light and fertilizing air (*aura cerealis*), thus transforming the milky humor into a sweet honeyed juice. On this account the caprifig should be planted near the fig, and on that side from whence the wind might carry the fertilizing breath. Now, this description is but little more than a copy of what Theophrastus had written so long before. These were the opinions of the learned as well as the usages of the country in the times of Herodotus, Aristotle, Theophrastus, Dioscorides, and Pliny; but however ancient was the practice in Greece, it remained there; for there is no tradition of its having been introduced into Syria or Palestine; and Pliny remarks that even at his time it was only in use in the islands of the Archipelago. It may, therefore, be affirmed with tolerable certainty that it was only brought from thence into our country (Italy), although, owing to the long rule of barbarians, it is impossible to fix the period of its introduction with any degree of probability.

After the revival of science, Cæsalpinus, about the year 1583, discovered the sexual organs in flowering plants, and thus the conjectures of the ancients became a certainty. Nevertheless, the opinions on the effects of caprification did not change in the least, and none of the botanists or agriculturists of the time, who treated of the fig, differed in this respect from Theophrastus, as may be seen in the works of Bauhin, who lived many years after Cæsalpinus. In the beginning of the last century, Tournefort, traveling through Greece, endeavored to ascertain the details and the effects of caprification, and whatever he saw and noted down he afterwards published. He follows the opinion of the Greeks with regard to the manner in which the effects may be produced, saying that the caprifig produces three kinds of receptacles (as we have elsewhere explained in detail) and three generations of the fly in the course of the year; that there are eatable figs which require the assistance of the caprifig to set; that the virtue of caprification consists in the bite of the insect, which, by enabling the superfluous milky juice to escape, causes the fig to set and ripen, and perhaps also some liquid issuing from the fly itself produces the saccharine fermentation by combination with the juice of the fig. Pontedera afterwards, in making known the structure of the flowers, as well of the caprifig as of the fig, states his belief that the fly acts upon the latter by giving admission into it to light and air. All of which statements differ in little or nothing from the opinions of the Greeks.

Meanwhile the discovery of Cæsalpinus, in the commencement of the preceding century, had more than ever attracted the attention of the learned, many of whom admitted the necessity of sexes for the fecundation of fruits, and especially for the purpose of obtaining fertile seeds, yet there were not wanting those who contradicted it, and amongst other grounds adduced the fig as ripening its fruit without fecundation. But the most sensible observers multiplied the facts relating to the

fecundation of vegetables; they ascertained that the female date was enabled to set and ripen its fruit, not by the insect, as Herodotus believed, but by the fertilizing powder of the anthers; and, amongst other remarkable circumstances, this also was discovered, that certain animals and vegetables lived under a kind of mutual dependence for the accomplishment of the operation. Thus, for example, it was observed that the male flowers of the gourd abounded in pollen, which is their fertilizing powder. With this pollen bees chiefly form their wax, and the bee flying from flower to flower carries it from the male to the female flower, which eagerly sucks it up, becomes fertile, and grows into the fruit. These facts and other similar ones having been related and proved, it appeared to the learned, and especially to Linnæus, that they explained the whole secret of caprification. This great botanist well knew that the fruit is the enlarged ovary, and that the fig commonly called a fruit is not the ovary, but a receptacle containing the flowers, and capable of enlarging without the assistance of fecundation. Knowing, moreover, by the researches of Pontedera, that the domestic fig only contained female flowers, and that the males were in the caprifig, and that in the one, as in the other, the flowers remained inclosed withinside the receptacle, he conceived the beautiful idea that the fecundation of the fig took place by a special provision of nature. This consisted in the creation in the caprifig of an insect which, for the purposes of support and propagation, was obliged to penetrate into the domestic fig, and carried with it the prolific humors. Thus fertilized the embryo was produced, and the greatest number of the receptacles remained on the trees, and came to maturity. In reply to those who followed the opinion of Camerarius, who said that the seeds of the fig never germinated, as well as to those who alleged on the contrary that fig trees could be only raised from the seeds of figs of the Greek Archipelago, or of Italy, with the remark that the statement of Camerarius was correct in regard to seeds produced in Germany, France, or England, where, there being no caprifig, the figs remained necessarily sterile, whilst, on the contrary, in Greece and Italy, where the caprifig existed, the fig seeds became fertile, either naturally or artificially, by means of caprification, this explanation appeared so just and natural that it was generally adopted.

2. *Concise Exposition of the Theory of Cavolini.*—Towards the close of the last century, Cavolini, who was in natural sciences the pride and ornament, not only of Naples, but even of the whole of Italy, sent to press a learned treatise on the present subject. He first describes the caprifig and the fig; then observes that they are but individuals of one species, the caprifig being androgynous and the fig the female plant; and he proceeds to endeavor to prove the necessity of caprification. The fig, he says, is a receptacle, or “a portion of the branch prolonged for the purpose of fructification, and not a pericarp, which is the external covering of the seed. The receptacle can support itself and attain its perfection without fecundation; but not so the pericarp, on account of its adherence to the seed by means of its vessels.” Nevertheless, he afterwards declares that this theory is not in all cases confirmed by fact, alleging that the receptacle of the strawberry, of the mulberry, of the blackberry, and of other plants, does not grow or become succulent till after the fecundation of the pistil. And from these data he argues, as to the mode in which caprification works, as follows: That which is



commonly called the fruit is a dilatation of the branch, and bears the flowers; but being different from the real branch in internal structure, the nutritive fluids meet with difficulties in passing from the large direct channels of the branch into the vessels of the receptacle, which are of a different structure and direction. On this account they would soon drop off if the female flowers were not fertilized; but as the fecundation induces an affluence of humors to the ovary, and thence to the receptacle, it follows that the one and the other continue to grow. And as this defective structure is greater or less in different sorts of figs, so (extrinsic) fecundation is necessary in some, superfluous in others, whilst others only require a very little of it. And if the same fig at Naples, for example, may require caprification, and not require it at Capri, it is because in the latter place the soil, reduced to the finest dust, and the air loaded, the one with alkaline salts, the other with phlogiston, could produce the same effect; that is, the setting and ripening of a large quantity of fruits. Thus it is that in certain places caprification is entirely unknown, as in the promontory of Sorrentum, Ischia, and other districts. Believing, therefore, that fecundation was necessary to sustain the domestic fig till its maturity, and that it contained only female flowers, whilst those of the caprifig were androgynous, with perfect anthers, it followed naturally that the fly coming from one to enter the other should carry with it the pollen or the fertilizing essence. He, consequently, thought it worth while minutely to describe the insect in its various states. Such is, in brief, Cavolini's theory of caprification, which we should have given in detail did it not appear to us to be too prolix and somewhat obscure.

3. *Exposition of the Theory of Galesio.*—Galesio, not long dead, has left a large treatise on the physiology of the fig and on caprification. We have extracted from it in their proper places whatever appeared to us of the most importance on the fig and on the caprifig, and we now proceed to state this author's opinion on caprification. He admits with Theophrastus, Pliny, and so many others, that there are figs which mature their fruits naturally, and others that require caprification. This difference was attributed by the ancients to climate and soil, believing that in a poor soil, with a northern exposure, the fig could nourish and mature its fruit without the caprifig; Galesio, on the contrary, affirms that it proceeds from a difference in organization, that the fig requiring the caprifig is quite a different kind from the others, and that both preserve their character and temperament in any soil or climate which they can bear. Now, the diversity in their organization, according to him, is this: Some figs have no flowers capable of being fertilized, as their ovaries are without ovules; these produce no fertile seeds, and cannot feel the action of the caprifig, which they do not stand in need of to preserve and ripen their fruit. These he calls *mules*, and says it is they which are cultivated in Spain, Florence, and upper Italy. Other figs, called *semi-mules*, have flowers susceptible of fecundation, the ovaries being furnished with ovules. In these fecundation generates the embryo, which causes the nutritive humors to flow to it from the peduncles, which can only draw them from the receptacle; this, again, cannot obtain the nutriment from anywhere but from the stem, and thus the fecundation occasions the setting and ripening of the fruit. And as it is only the caprifig that can produce this effect, so caprification is necessary for the perfection of these *semi-mule* figs. Such

are, he says, the figs of the Archipelago, and many of those of the kingdom of Naples, all producing female flowers only.

4. *Opinions against Caprification.*—There are many who will not admit that any effect is produced by caprification, and these are chiefly ignorant or simple cultivators, who judge from observing that in many places figs ripen without the coöperation of the caprifig. But with these must not be confounded two distinguished French naturalists, Olivier and Bory de St. Vincent, who have enounced the same opinion. The former, after having explained the process as practiced in Greece, adds: "This operation, of which some authors, both ancient and modern, have spoken with admiration, appears to me to be nothing more than a tribute of ignorance, which man pays to prejudice. Caprification is unknown in many parts of the Levant, in Italy, in France, and in Spain, and begins to be abandoned in some islands of the Archipelago where it used to be practiced, and which, nevertheless, still produce excellent figs for eating. If the operation were necessary, whether fecundation be effected by the fertilizing pollen dispersed in the air, introducing itself into the mouth of the fig, or whether nature make use of a little fly to transmit it from one fig to another, as is commonly believed, it is evident that the first fig in flower could not fecundate at the same time as those which have already attained a certain size, and those which are only just appearing, in order to ripen two months later." I do not transcribe the words of Bory, for his narration appears to me to be but a judicious illustration of what Olivier had stated.

And here I close the history with the following brief recapitulation of different opinions of authors on the mode of operating of caprification: The ancients believed that its virtue depended on the fly of the caprifig, which, by forcing its way into the domestic fig, facilitated the entrance of light and some fertilizing or fermenting vapor, and enabled the fig to set and ripen, and that a poor soil and northern exposure produced the same effect. Tournefort believed that the insect made the figs set and ripen by pricking and biting them, giving an issue to the superfluous juices, and perhaps by communicating some peculiar humors of their own produced the saccharine maturation. Pontedera followed the ancients, whose theories were all based on that of Theophrastus. Linnæus concluded, from the observations of Pontedera on the structure of the flowers of the caprifig and the fig, that the latter could not be fecundated without the assistance of the caprifig, and that this fecundation enabled them to set more abundantly. Cavolini combined in some measure the theories of Linnæus and of Theophrastus, affirming that the caprifig fecundates the fig, and thereby causes it to bear more fruits and ripen them better; but that the same fig can also ripen its fruit in certain districts by the sole effect of soil and climate. Gallesio follows Cavolini in so far as regards the action and effects of fecundation, but believes that neither climate nor soil can produce anything of the kind; and that the figs which do not require caprification differ from the others in the internal structure of their flowers. Lastly, the opinion of our cultivators is nearly that of the Greeks. They believe that the caprifig is necessary for some figs, which, without it, would lose the whole or the greater part of their fruits, whilst still sour, and that it hastens the maturity even of those figs which do not absolutely require it. They also admit that the quality of the soil and climate may, in some cases, produce the same effect as caprification.

5. *Comments on the Above Opinions.*—The ancient philosophers and naturalists admitted, as every one knows, four elements—earth, water, air, and fire—the which, combined together in various ways, produced an infinity of phenomena and things. Now, Theophrastus, wishing to explain how it could happen that the fly should cause the young figs to remain on the tree, bethought himself that, whilst the fig abounded in humidity, it was deficient in the air and heat necessary for fermentation, and that the insect, by feeding, carried off precisely the superabundant humidity, and by opening the mouth gave entrance to air and heat; and as this happened naturally in a poor soil and northern exposure, there was no occasion for the assistance of the fly. But in the present state of science, who would believe in the attribution of such powers to the soil and the north wind? On the contrary, such circumstances would rather produce an opposite effect; for the want of humidity and cold tend rather to contract the parts. And if any one were to see in the *aura cerealis* of Pliny that which is now called pollen, or the fertilizing dust generated in the anthers, would probably be mistaken, for it appears to me that the epithet *cerealis* denotes nothing but fertility or abundance produced by the *aura*. The opinion of Linnæus has, in truth, all the appearance, I do not say of probability, but even of certainty, of being simple and analogous to what takes place in a great number of vegetables. And that of Tournefort, if one does not entirely give faith to it, has, nevertheless, much of probability, considering that in other fruit trees the ovary, being pierced by an insect for the purpose of depositing its eggs, does not fall off on that account, but ripens like the others, only a little earlier.

Cavolini's theory is derived directly from Linnæus, only that his explanation of the manner in which the fecundation makes the fruit of the fig set is ingenious, and even rational. Admitting, then, for the moment, that the fact is as stated by that celebrated naturalist—that is to say, that in certain figs the nutritive juices cannot pass readily from the branch to the fruit (on account, as he says, of the extreme tenuity and curvature of the vessels), unless attracted by the embryo generated by fecundation—yet he has not shown that in the figs which ripen without caprification these vessels are really less curved or larger. Now we have proved that the structure of the receptacle in all the varieties of fig is tolerably similar. And his observation that the fine dust of the soil might produce fecundation is now wholly inadmissible. For although towards the close of the last century there were some who believed they had obtained perfect seeds furnished with embryo, by fecundating the pistil with very fine charcoal dust, later experience has entirely disproved it. As for the virtue attributed by authors to the alkaline salts of the earth, or the phlogiston of the air, as being capable of producing the same effect, it can now no longer be supported without offending the dignity and grandeur of science. Galesio's opinion is essentially that of Linnæus, as to the importance and the action of fecundation; and he follows Cavolini in admitting that certain figs require caprification and others do not for the ripening of their fruits. But he does not see the cause of this diversity either in soil or climate, but in their different organization, believing that those figs only which have their flowers apt for fecundation require the caprifig, as well to produce the embryo as to ripen the fruit. Nothing further can be deduced from Galesio's work, in which, to my mind, there is great confusion, owing partly to precon-

ceived and ill-defined ideas, such as that of the distinction between *mule* and *semi-mule* varieties, partly from the author not having precisely stated in what consists the diversity of structure on which he founds his theory, and, above all, from this, that he never himself saw the operation of caprification, nor examined the variety of fig on which it is performed. Moreover, his own theory, which we have perhaps stated more clearly than he does himself, appears to be in contradiction with itself in the two principal points. For if, in the variety called by him *semi-mule*, the sap of the branch passes into the receptacle, attracted by the action of fecundation and the vital power of the embryo, how is it that in the other variety the same cause does not produce the same effect? And here let us repeat that the different receptacles of the same tree, of whatever sort the fig may be, do not differ from each other in the least in the organization of the vessels, the parenchyma, and the fibers.

Such are the ideas of authors on caprification. Were we certain that Theophrastus and Pliny had intended by the word *aura* to denote the pollen, all would have joined in one general idea, that of fecundation. But in the history of the different opinions, as given above, one remarkable fact is included, which may not appear at first sight, which is, that with all the subtle fancies conceived by authors in their theories and explanations, not one of them has put forward a single experiment; but all, preoccupied with the certainty of the fact, have aspired at nothing but discovering the reason—even those who had good opportunities of actual observation. And Olivier, in denying to caprification any power whatever, comes to that conclusion not by experience, but by a just and rational operation of the mind.

But as it appeared to me not only worthy of the labor, but most essential to the consideration of the subject, to ascertain the truth by experiment, I have applied to it all the care in my power. The questions I have chiefly endeavored to solve are:

1. Does the caprifig fecundate the flower-heads of the domestic fig, and make them remain on the tree in greater numbers?
2. Does the caprifig fecundate the female flowers of autumnal figs, and make them set?
3. Does the caprifig hasten the maturity of the autumnal figs, or of the fruit of any sort of fig?
4. Does the caprifig operate by means of the puncture made by the fly?
5. Does the caprifig operate in any other way than any of the preceding, and by any process as yet unknown?

The figs near Naples which always produce fruit are chiefly of two kinds, the Colombro and the so-called Paradise fig. On two middling-sized trees—one of each of these kinds—I suspended towards the end of April some *cratiri*\* of the caprifig, called by our cultivators *Mamme di propichi*, or *caprifig teats*. The fly entered the flower-heads of the fig, but they did not set in greater numbers on each branch than was the case on similar fig trees not caprifigged, and growing far from any caprifig. In the ripe figs I could not find a single seed with an embryo; they were all sterile; some quite empty, others containing albumen only, and when sowed would not germinate.

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\*These are explained in the first part of the memoir to be those young figs of the caprifig which first appear in September, and remain through the winter till the following spring, when they come into flower.

At Baja the Dottato fig almost always ripens its fruit. Whoever passes by that district will readily observe places where the Colombro and the Dottato figs are so close to the caprifig that their branches intermix. Yet there are no signs among them of early maturity, when compared with similar fig grounds far from any caprifig. These figs naturally do not bring all their fruits to perfection; those that fall are at Baja called Sbufoni, and this usually takes place about the end of May or the first half of June.

In these fallen fruits, in the vicinity of the caprifig, there are generally dead flies, and never seeds with embryos. Out of fifty figs recently fallen from a Colombro, which I examined on June 17th, five only contained no insect; the remainder had them in greater or less numbers, but were so destroyed inside, and black and rotten, owing to the insects which had died in them, that to all appearance that was the cause of their falling. On the same tree were a number of figs looking nearly ripe, but slightly pricked and insipid, and which fell off with a slight shaking of the tree. Some of these contained insects, others did not; the former, like the fallen ones, were destroyed, and black inside. As to the permanent or set fruits, which in the middle of June can well be distinguished from the others, there were some with the insects, others without. In the fallen fruits of the Dottato fig I did not find one which had not the fly; but among the permanent ones there were some free from it. These experiments and observations were repeated three consecutive years, whilst every attempt proved vain at making the seeds of these figs germinate, though they were sown under a variety of circumstances, and at different seasons. The fly, therefore, which issues from the *cratiri* of the caprifig towards the end of April produces no effect on the domestic fig, either in fecundating their female flowers or in making them remain on the trees, or in hastening their maturity. If in the latter respect a precocity may sometimes be observed, the difference is so slight as not to be taken into account, considering the diversity of aspect, the trees being more or less exposed to the sun. The size of the tree, the being single and uncovered, or choked by the surrounding vegetation, may also occasion some difference, even at very small distances. Indeed, the different branches of one and the same tree ripen their fruits at different times. That the Dottato fig should ripen its fruits at Baja is not to be attributed therefore to the caprifig planted there, but solely to the climate, or perhaps to the soil, for the same variety near Naples will produce nothing, even with the caprifig, and in other localities will do as well as at Baja without it. And on the Lardaro fig, which never ripens naturally, at least in the vicinity of Naples, although the fruit enlarge considerably, and some remain on the tree till the end of May, often as I have attached to it the *cratiri* of the caprifig, I never observed a single one ripen. Therefore, I conclude that the remaining and maturing of the figs depend upon two circumstances—the intrinsic properties or natural disposition of the variety, and on the quality of the soil and climate.

6. *Does Caprification Hasten the Maturity of Late Figs?*—In the district of Portici I made the following experiment: In a large property there were two small trees of the Sarnese fig, distant from each other about two stone throws, and about equal in size and vigor. To one of them only, about the end of June, I hung the flower-heads of the caprifig, and I counted the fruits upon each tree. In the first days of September

there was no difference between them. Each had some ripe figs, some still sour, and others commenced ripening. Counting them again, there was here also no difference, each tree having lost about a fourth part of its fruits. The following year I repeated the experiment, with some modification. I marked with thread or with twine the figs into which I saw the fly had penetrated, and I took care that there was no caprifig in the vicinity of the other tree. The result of this experiment was precisely the same as that of the preceding year. In the meantime I had suspended five flower-heads of the caprifig to a large branch of a Lardaro fig which rose considerably above the rest of the tree, thinking that however little the caprifig might hasten the maturity, the slight difference would nowhere be more perceptible than in the different branches of the same tree. Yet when maturity commenced numerous fruits on all parts of the tree were in the same state as those of the branch in question. Now it appears improbable, not to say impossible, that those five caprifig flower-heads should have furnished insects enough for so great a number of figs.

I repeated the experiment for four years, and always with the same results, though in different localities. At the Camaldoli, where caprification is not practiced and the caprifig very rare, I caprifigged copiously a Dottato fig and two white fig trees, and none of the three showed the least sign of precocity. I believe, therefore, that the insect does not at all hasten maturity. It must only be observed that maturity is not to be confounded with a certain early softening which happens to some of the deciduous fruits pierced by the insect. For, as will be seen hereafter, the fly destroys and corrupts the inside of the fig; when it is already disposed to fall, it falls the earlier, and by rotting inside becomes soft the sooner.

7. *Does Caprification Cause Late Figs to Set in Greater Numbers than Usual?*—The advocates of caprification affirm that in certain varieties it causes all, or the greater number of fruits, to remain on the tree, which otherwise would have fallen off. To verify this assertion I have many times made the common experiment which would occur naturally to any one, that of comparing fig trees of the same variety to some only of which the caprifig had been brought, in order to observe the difference. Those I have observed with that view are the Lardaro, the Sarnese, the Colombro, and the Sampiero. With regard to the first two, the experiments were made in different localities, especially on the Sarnese, which is very common. None of them showed the slightest effect of the action of the fly, in regard to the quantity of the fruit; and if ever any differences were exhibited between the caprifigged trees and those not acted on by the caprifig, either in favor of or against caprification, they could always, on being well considered, be clearly traceable to other causes (not to speak of soil, climate, vicissitudes of seasons, etc.), as for example, to the age or vigor of the subject, the number of branches, the having been or not enfeebled by a previous superabundant crop, etc. And what I say of the Sarnese may in like manner be said of the Lardaro, with this exception, that being cultivated almost exclusively in the immediate vicinity of the Capital, I had no opportunity of observing it in distant localities. Cultivators affirm that this variety more than any other stands in need of caprification, and indeed it loses generally nearly the half of its fruits. But of this variety I will only state two things, not to fall into lengthy repetitions: First, that the

caprifig trees lose also a great quantity of their figs; and next, that those not caprifigged ripen many of theirs, with such differences as are occasioned by the above-mentioned causes or others to which I shall presently advert.

The double-bearing figs, such as the Paradise, the Colombro, and the Sampiero, usually bring many of their early figs to maturity, and but few or none of the late ones; and cultivators affirm that by caprifigging an abundant second crop may be obtained. Although I had often seen the Colombro ripen many of the late crop without the caprifig, I nevertheless wished to see the results of comparative experiment. Therefore, in the beginning of July, in the neighborhood of Pianura, I gave the caprifig to several trees of the Colombro fig; amongst them many had lost all their figs by the middle of August, some retained a few; they had fared like other trees of the same sort not caprifigged and placed at a considerable distance. Among the fallen fruits some contained the insect, others did not, and it was the same with those that remained on the trees and were advancing toward maturity. Amongst these Colombro figs were several trees of the Sampiero, of which four were caprifigged. The result was that two of them lost all their figs, both those at the base of the fruit-branches, called *pedagnuoli*, and those of the extremities, called *cimaruoli*. The other two trees scarcely ripened a fourth part, and those chiefly *cimaruoli*, and the fly had penetrated into some of the fallen fruits. It must be noted, moreover, that the above fig trees were all of the same age, in the same soil, with the same exposure, and all more or less had brought to maturity a good, early crop. The same experiment, repeated at Ischia on two trees of the Colombro, produced no result. For if these trees were pretty well loaded, the same thing took place in many other parts of the island without caprifigging, and not infrequently in the same places were fig trees near to each other, some with and some without fruits, without anything appearing to show a probable reason for such diversity.

8. *Does the Caprifig, by the Assistance of its Insect, Fecundate the Female Flowers of the Late Figs?*—As soon as botanists learned, from the observations of Pontedera, that the flowers of the different varieties of the domestic fig were always all female, as well in the early as in the late flowers, and as they believed that the caprifig was the male plant, they at once, by common consent, without further observation, concluded that these female flowers could only be fecundated by means of the insect—recognizing in this a providence of nature for the accomplishment of that important function. And I, myself, having ascertained the correctness of the fact stated, came naturally to the same conclusion, although I had ascertained that the caprifig was not the male of the fig, but a very different plant. But in the course of time doubts gradually suggested themselves to my mind, to remove which I devoted myself to ulterior researches. First, it appeared to me impossible that in all sorts of early figs there should never be a single fertile seed, even when male flowers were present. Yet, after repeated examinations, I always found such to be the case. This must not excite surprise, however, on considering that the flies which enter these come from the *cratiri* (the young figs of the caprifig that were first formed in the previous autumn), in which are either no male flowers or very few, and those almost always imperfect, and with little or no pollen. And then, if in these early figs I occasionally found a male flower, it was only

formed long after the female flowers, and its anthers never opened, so that any one might conclude that if there were no fertile seeds it was for want of fecundation. What is surprising, is the fact that in the late figs the embryo is produced especially in the *pedagnuoli* (at the base of its branches), and in hot situations, whether the tree be caprified or not. The White fig, the Dottato, and others which the Neapolitans do not caprify, produce abundance of fertile seeds, even in places where caprification is never practiced, and where the caprifig itself is rare, as, for example, at Camaldoli, Ischia, etc. But such observations always leave some doubt whether the insect may not have come from somewhere else, and effected fecundation. In reply to which it must be remembered, in the first place, that this insect, when he issues from his nest, flies with difficulty to any considerable distance; and next, that after he has entered the fig he dies there, and is afterwards to be found either entire or partly decomposed; at the least there remains, as a sign of his having been inside, a brown spot, which easily turns to decay.

Now, in places where there are no caprifigs, and where caprification is not practiced, I have found the seeds perfect in figs which did not show the least sign of the insect having penetrated. Besides, towards the middle of July I impregnated artificially thirty flower-heads on a Lardaro fig, by introducing into the aperture the pollen of the caprifig; one month after ten of them had fallen from the tree without their seeds being fertilized, and the remaining ones did not differ, either in size or in the number of fertile seeds they contained, from the numerous others of the same tree which had neither been caprified nor artificially impregnated. Not satisfied by all this, I made three consecutive years an experiment which appears to me more important than all the above-mentioned observations. Before any flies began to issue from the caprifig flower-heads, I closed the apertures of some still small figs of the Lardaro and Sarnese varieties with gum arabic mixed with chalk, so as to prevent the insect, should he attempt it, from penetrating within; and I took care to add some of the mixture as the figs grew, to keep them well closed. When they attained their full size I opened them; they showed no sign whatever of the fly having penetrated, yet they contained seeds with perfect, well-formed embryo. If this experiment is made upon trees to which the caprifig is afterwards applied, it is a curious thing to see the fly, after issuing from its nest, seek a place to deposit its eggs, and, lighting upon the closed fig, exert itself with all its might to penetrate all around the mouth, trying to force it open where it was only slightly green, and finally, seeing all its endeavors hopeless, turn away from it. This experiment clearly proved that caprification was not necessary to generate the embryo of the fig, though it was not conclusive as to impregnation not being requisite. For it might have happened that some organ or other under some strange form might contain the pollen, and be found on or amongst the female flowers.

With this view I examined with the microscope, with all the care in my power, all the internal parts of the fig in every stage, from its first appearance to the attaining its full size—the scales under the mouth, the pedicels, the bracts, the perigone, the pistil from the base to the summit—and I never succeeded in discovering anything which contained pollen, or any other analogous substance which might be even suspected of producing impregnation. Only it must be observed that



on the style, from its young state till shortly after the changes that take place in the ovulum, or about that time, there appear certain obscure grains, which at first sight have some resemblance to those of pollen. On attentive examination they proved to be little glands with the appearance of wrinkled grains, composed of cellular tissue; and as they first appear so they remain. The same grains appear also in the caprifig and in exotic figs. Besides, it appears that the style has not the tissue for conducting the pollen, unless you would give that name to the internal part of the style, formed of longer and more slender cells than those of the exterior, as may be so frequently observed in lengthened slender organs of numerous dicotyledonous plants. Thus every attempt on my part to discover any need of the fecundating substance of stamens to produce the embryo had failed. And, if I am not mistaken, this is not an isolated fact in the science, Mr. J. Smith having (Transactions of the Linnæan Society, 1840) already announced that the female of a dioecious plant, indigenous to New Holland, of the family of *Euphorbiaceæ*, called by him *Coelebogyne*, bears in London\* fertile seeds without a male flower having been discovered on it, and without any suspicion that it could have been impregnated by the pollen of any allied plant; and whoever, in answer to what I have stated of the fig, should allege the assertion of Linnæus, that this tree only produces good fruit where the caprifig grows, must recollect what I have said respecting it—that differences in climate and season more or less hot cause more or less of the seeds to remain empty, and that on that account, in the northern parts of Europe and in stoves, the seeds would probably always remain sterile.

So it is with our Vernino fig, as to the fruits which it ripens in the open air in November and December, and with that treble-bearing La Cava fig, which will sometimes ripen in a room in the depth of winter. On the other hand, the appearance of the summer figs at a time when the flower-heads of the caprifig are in a state of perfection, the insect ready to come out, shows in a manner a *final cause*, which can hardly be anything but fecundation. This consideration has always deterred me from publishing the results of the above-mentioned experiments, and has been the cause of my repeating them so often. What may be really the design of nature in this combination I confess I am ignorant of. Nor do I pretend, with the single example of the fig, to disprove so universal a fact as is the necessity of the concurrence of pollen and impregnation for the generating of the seminal embryo, proved by innumerable experiments made by so many distinguished men for a century back. I only state what I have seen in this plant, it being possible that others with a more acute judgment than my own may loosen the knot and discover one of the numerous contrivances by which nature meets so frequently her wants, when for the fulfilling of some particular end she adopts secret and complicated modes, with strange and unusual disguises.

9. *Does the Fly Cause the Setting and afterwards the Early Maturity of the Fig by the Puncture it makes in it?*—The ancients believed that the quantity of humor in the fig might be the cause of the late ripening of its fruits, or by suffocating them that of their falling off when still sour, and that whatever diminished the quantity of humor, if it

\* At Kew Gardens.

did not cause them to set, at least would aid in that operation. And the celebrated Tournefort was of opinion that the insect produced that effect by piercing or gnawing the mouth, or the inside of the fig, so as to draw out the superabundant fluids. This opinion has been followed by many among the moderns, it appearing to them that the case of the fig should be in every respect compared with what occurs often in pear, apple, and other fruit trees, in which it is manifest that the blighted fruits ripen some days before the others; and Bernard, of Marseilles, a distinguished agriculturist, as I read in Gallesio, is of the same opinion, it appearing to him that what happens from the fly can be proved artificially by pricking the unripe figs with an awl, or even with a straw, and putting a little oil on the puncture. But I think that such ideas and reasonings, founded on analogy, are worth nothing in the present case, for before coming to the explanation, they ought first to have ascertained whether in fact the fly does or does not hasten the maturity of the fruit, and we have already seen that it does not. Besides, it is not proved yet that the insect pierces the mouth of the fig at all, nor any other part, excepting, perhaps, the ovary in order to deposit its eggs in it; on the contrary, I believe that it never does; for looking with attention, I have observed it make its way from scale to scale, sometimes unable to overcome the resistance they oppose, nor ever breaking through any of them to clear its way; and these scales, examined under the microscope, showed no injury from the passage of the insect. But supposing the fly to have pierced or otherwise injured some scale or other, it does not follow thence that the fig must ripen earlier, when we often see it injured or gnawed away in some places—ants often enlarge the mouth and carry away the scales—and yet these injured fruits either never ripen earlier, or very rarely so, and that from other causes. That puncture and oil hasten the maturity is proved by experiment, but this puncture operates in a different manner, in my opinion, from that which insects make into the ovaries of pears and apples to deposit their eggs. For amongst the pears and apples containing insects' eggs, some, whilst they are growing and still acid, become diseased and fall; others, continuing to grow like those that are not touched, become soft when the grub issues from the egg and commences feeding on the pulp; and this pulp is then sometimes, but not always as some believe, of a good flavor. But the fig in the above-mentioned experiment does not ripen from the puncture, but from the oil, as the same effect is produced by putting a little on the mouth of the fig. How it produces that effect on the fig is unknown to me; being put on the mouth it contracts it, then gradually the oil spreads, and wherever it reaches the dark green color of the epidermis changes to a bright green. I thought that I perceived that it did not affect the milky juice in the least, but rather impeded evaporation or other functions of the epidermis, as well in respect of light as of air, and that on that account the anointed fig commenced ripening from the base, and was inferior in flavor to those ripened naturally. But to return to the case of the fly: it neither pierces nor gnaws the substance of the fig, and if it inserts its eggs into the ovary, which I can neither affirm nor deny, it is certain that nothing is hatched from them; but I am inclined to think that it does not even pierce the ovary, as it does not prevent the formation of the embryo, and the difference between the fig and the caprifig is very great.

10. *Action of Fruits which are Ripe and in a State of Decomposition upon those which are Younger and Sour.*—In making my experiments on

caprification, as I was at a loss to conceive in what manner, visible or concealed, the fly operated, it occurred to me that possibly the caprifig flower-heads suspended to the fig tree and rotting there might possibly, by their close proximity to the sound figs, excite in them some similar alteration, which might bring on a premature softening. This suspicion arose from observing in stores of apples and pears that any rotten ones amongst them readily communicated their decay to the sound. In applying this to our case I did not intend to put forth any theory on the subject, as the science has not as yet any means of determining what it is that brings on the decay of any particular fruit, nor its effect on others around it; but what cannot be known by direct experiment may frequently be admitted or presumed by analogy and comparison; and as to the present question, as we have proved that the caprifig does not hasten the maturity of figs, it follows that such a discussion is idle. Nevertheless it may not be wholly useless, I think, to take the opportunity of relating an experiment I made for the purpose of ascertaining what I have alluded to.

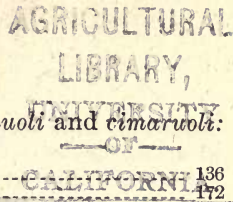
Oranges, when they decay, produce mold and emit an offensive smell. On that account, and by reason of their temperature being probably affected during the change, I suspected that decayed oranges might, on the tree, cause the healthy ones around them to rot; I therefore gathered several oranges with their stalks and laid them by, and as some began to rot I hung them by a bit of twine close to others which were perfectly sound. The experiment lasted about a fortnight, by which time the moldy oranges had dried up, but none of the others, not even a single one, caught the disease, and all remained sound a long time after. It then occurred to me that if the mold touched the skin of the healthy orange it might produce the decay; I therefore scattered the dust (or otherwise, the seeds or spores) of the mold in great quantities on some oranges, and on others I introduced it underneath the skin, as a contagious disorder is inoculated. But nothing of what might have been predicted happened; the wound, instead of festering, dried up, and in one orange, which after some time began to decay, the rot appeared on the opposite side to that of the wound. From this experiment, I should say that if oranges when moldy and exhaling an offensive smell do not communicate the disease to healthy ones on the tree, and if the mold only propagates on oranges already decaying, is it credible that ripe figs of the caprifig, beginning to decompose, should produce such an effect on the young domestic fig?

11. *Examination of Fallen Figs.*—If the insect has penetrated into the fig it can be known at once by opening it, and sometimes even that is not necessary when the insect is entangled and suffocated amongst the first scales of the mouth, leaving outside its wings and the posterior parts of its body. If, however, it reaches the inside of the fig below the scales, it does not easily decay, but remains nearly entire till the fig begins to show signs of maturity; then it becomes buried in the swelling and softening florets, and soon decays. But whenever the insect dies immediately the surrounding parts turn brown, and subsequently blacken and rot, even the scales of the mouth, which are harder than the other parts, but especially the stigmata and styles in the cavity, as they project beyond the perigone and bracts, and not infrequently also the ovary and part of the receptacle. This rarely happens where the insect does not penetrate, and if the style discolors or dries up, it

never becomes black or rots. At any rate, experience is a better guide than words, and a single glance of a practiced eye will tell with certainty whether the fly has been in the fig or not. Now, every variety of fig sheds a certain number of its fruits, some more, some less; and in the opinion of cultivators, the Lardaro, the Chiaja, and the Sarnese would lose all or most of theirs but for caprification. If such were the case, one would naturally conclude that what fruits should fall after caprification would be precisely those in which the fly had not entered. With this view I, one year, set to examining all the figs that had fallen from the Lardaro, the Chiaja, and the Sarnese, all caprifigged. On July 29th (the fall of the fig commences towards the end of this month and the beginning of the next) I collected under the Sarnese sixty-seven fruits, of which thirty-five had the insect; three days after thirty-one, of which twenty-four had the insect; the remainder were black inside, but without any fly—perhaps it had got out again. Afterwards I found one hundred and twenty-two fruits with the insect, one hundred and forty-one without. They were of different sizes, *pedagnuoli* which had first appeared in June, and *cimaruoli* of July.

This experiment does not prove, indeed, whether caprification had been of use or not, except that if it had worked as the cultivators believed, we ought at least to have found the largest proportion without the insect, when, on the contrary, those with the insect equaled the others, or surpassed them in number, admitting that the fly had left many. Where I made this experiment I left at a certain distance another Sarnese tree without the caprifig, under which I at several times collected two hundred and forty fruits, amongst which thirty contained the insect, which had come from other trees, although at a distance. I wished to compare the number of fallen fruits of the two trees, but I found it almost impossible to ascertain how many fell and how many remained; and where this could be done the conclusions were fallacious, as it was difficult to find two trees of precisely the same vigor and temperament. Near the one of which I speak was a variety of the other, produced from a seed which had sown itself in the fissure of an old wall, with the fruit rather larger, the peduncle rather longer, the pulp rather finer and whiter.

On July 24th I found fourteen fruits of the Lardaro with the insect, and twenty-seven without; on the 30th, under several caprifigged Lardaro trees, I collected one hundred and sixty-eight *pedagnuoli* (about an inch long), and a great number of *cimaruoli*. Of the first, sixty-six, with the styles decayed and blackened, contained the insect; twenty-nine had them similarly decayed, but the insect had probably escaped, and seventy-three without the fly had not altered inside. Amongst the *cimaruoli* some had the insect, some not. On August 2d, fifty-five *pedagnuoli* with the fly, twenty-five without, and a great many *cimaruoli*, as before. On August 9th, forty-eight with the insect, fifty-six without; on the 17th, about two hundred with the insect, and as many without. Thus, out of seven hundred and ninety-three fallen figs of the Lardaro, a little more than half (four hundred and twelve) contained the insect; the others (three hundred and eighty-one) did not, and showed no sign of decay or other change.



Of the Chiaja fig I counted of fallen fruits, *pedagnuoli* and *cimaruoli*:

Containing the fly—	
July 24th .....	136
July 27th .....	472
July 29th .....	164
August 3d .....	473
Total .....	945
Without the fly—	
July 24th .....	46
July 27th .....	20
July 29th .....	47
August 3d .....	127
Total .....	240

In this case there appears a great surplus among the fallen fruits of those into which the insect had penetrated, so that its effect appears rather to have been prejudicial. The trees had been abundantly caprifified, and in every fruit there were generally more than one insect in the cavity or amongst the scales; but more frequently amongst these, and around the insects, there were evident signs of corruption. The fruits without insects generally showed no alteration, excepting that in some the greater part or all the styles were faded, dried up, or slightly discolored. But the results of the above-mentioned enumeration must not be considered as invariable, for the same fig tree bears very differently in different years, according to the season, as well as to the quantity it bore the preceding year; and, besides, the finding more or less of the fruits with insects depends on the greater or less quantity of caprifified fruits suspended, and the period when that was done, as there are some cultivators who caprify three times, and then the insect is found as well in the *pedagnuoli* as in the *cimaruoli*. Last year, having returned to the same fig trees, and again examining their fallen fruits, I found the proportions a little different from those I had ascertained the previous year. In the Sarnese fig the fallen fruits without insects surpassed the others by about a third; in the Chiaja and the White fig the numbers with and without the insect were about equal, and in the Lardaro the proportions were much the same as in the preceding year.

Although I examined an infinity of ovaries in the fallen caprifified fruits, I never could discover with the microscope the least sign of their having been pierced by the insect to introduce its eggs, and never found anything within resembling a grub; thence it is probable that the insect does not pierce them. I say this in order to call attention to the circumstance that the blackening and decay around the ovary is not to be attributed to the puncture, which we do not know to take place, but to the body of the insect itself, which produces the effect either by some unknown action, or by some acrid humor it contains. Thus, from the above observations, it may be concluded that the fly of the caprifig is rather injurious, and that far from making the fruits remain on the tree, it either causes or facilitates their fall, especially when it has penetrated into the inside and produces decay, where it dies. But this I think will happen rather to the deciduous than to the permanent fruits, because the first, even though they be *pedagnuoli*, are by their nature disposed to fall, hold but slightly to the branch, have but little firmness in their pulp, the florets but little grown, and the inner cavity large. If with this bad conformation, either natural or superinduced pending the growth, the fly comes to inflict further damage, every one must see that the fruit

cannot on that account remain longer on the tree than it would otherwise.

Amongst a great number of fallen fruits, some, whether with or without the insect, showed a few florets which had grown more than the others, and had had time to form their embryo.

12. *Examination of Permanent Figs.*—The examination of the fallen figs was naturally followed by that of those which remain on the tree to ripen, in order to ascertain whether they contained the insect, and whether it induced decay. But in this research a source of error might lie in the mistaking for permanent fruits those which might still fall before they ripen; these, however, although they may appear to hold firmly onto the bough, may be known practically by a peculiar look, by being usually badly formed, imperfectly nourished, of a paler green than the rest, and emitting when pierced a small quantity only of a thinner milky juice than the sound ones.

On August 1st I cut from a caprifigged Sarnese fig a branch bearing eight fruits; one ready to fall contained the insect; so did three others of a doubtful kind, that is to say, not showing clearly whether they would come to maturity or fall prematurely, they showed the usual blackening, although slight, of the ovary. The remaining four, intermingled with the others, were strongly attached to the bough, had no fly withinside, and showed no sign of alteration. Two days later I cut from the same tree another branch with sixteen fruits, of which one with the blackened styles from the presence of the fly was in the act of falling; two of middling size and firmly attached contained the insect, not in the cavity, but amongst the scales of the mouth, and were little if at all affected; a fourth, the youngest of all, although it contained the insect, appeared to be set, and was not injured. The remaining twelve, all *pedagnuoli* of middling size, were sound and secure, had neither fly nor any sign of decay. On August 5th I cut a third branch with eleven fruits all set; four contained the insect, the other seven did not. In the district of Portici a branch of the same variety of fig with nine fruits had the insect in two fruits ready to fall and in three permanent ones. At the same time on a Sarnese fig I found, besides a number of fruits ready to fall, with the fly, thirty-seven permanent and large fruits, of which ten had the fly. From a Chiaja fig copiously caprifigged I detached in the beginning of August forty-three well set figs, of which only thirteen were without the insect, which in the others was either among the scales of the mouth or in the cavity, or in both; but always when among the scales it does little damage. And the following year, among eighty fruits of the same tree thirty-nine only had the fly, which I also found in seventy-four out of one hundred and ninety-four fruits of the White fig. In the first days of July I suspended some caprifig flower-heads to a small tree of the Lardaro which had one hundred and seventy fruits; in the course of the month forty-three had fallen; I gathered on August 14th the remaining one hundred and twenty-seven, which had become consolidated. Having opened them, I found them sound, with good seeds; about thirty only contained the fly, which had done little if any injury to the florets.

The facts noted of the Sarnese and Lardaro figs prove clearly that it is not by the effect of the insect that the fruits remain on the tree, as the greater number of those which were the soundest and most vigorous did not contain it. The experiment made the first year on the Chiaja

fig might perhaps tend to show the contrary, were it not that there was so far a greater proportion of the fallen fruits into which the fly had penetrated. That arose from the great quantity of the caprifig, which had been applied three times, so that few of the fruits, whether deciduous or permanent, could escape the insect. Therefore, from the observations stated under this and the preceding heads, it follows that the insect is not the cause of the permanence and setting of the late figs. If it had been so, it would have been found only, or at least chiefly, in the permanent fruits, whereas the contrary was always observed; and I am of the opinion that a fig tree, whether caprifigged or not, always loses the number of fruits it is destined to lose, from whatever cause—either its own temperament or external causes—and that the deciduous ones fall the more readily from the flies having penetrated into the cavity and induced decay and mold; and it may happen even that on this account many a fruit falls which might otherwise have consolidated itself and ripened. As to the permanent fruits which had the fly, I think that from their size, strength, and vigor they had been enabled to resist the effects of it, especially where it remained caught among the scales of the mouth; but as soon as they commence ripening they rot very easily, the flavor becoming affected.

But as in all our researches and experiments we have been unable to discover any reason in the world why the caprifig fly should render the deciduous fruits of the domestic fig permanent, or hasten their maturity, and as it cannot be denied that some varieties lose every year a great many, others very few, and that some ripen earlier, it would be desirable to know how this happens; and this question I will now shortly discuss.

13. *For what Reason does the July Fig Commence Ripening Some Days Earlier than the Others?*—Of this fact I see chiefly three causes: First, the tree shoots out some days sooner than other varieties; secondly, it puts out but few or only very small early figs, which fall off very soon; thirdly, the young branches do not lengthen much and grow pretty equally, throwing out scarcely any coarse, watery shoots. It follows naturally that vegetation commencing early, the flowers are also formed early, and the nutritive juices not being taken for the spring figs, nor drawn away to the extremities of the branches, are directed in greater abundance to the summer figs. What is there then surprising in their ripening a few days earlier than other varieties? The contrary effect is observed in the absence of any one of the above circumstances. The winter fig produces few small and deciduous early flowers (the growth of the branch is rather weak than otherwise), yet vegetation being about a fortnight later than in the Dottato and other figs, that is enough to occasion its fruit to ripen late. The Colombro, worn out by the quantity of early figs which attain maturity, produces late in the season only a few late ones, and those usually fall off unripe, either all or the greater part of them; indeed, that the vigorous growth of new branches retards the ripening of fruit can be proved by this, that if their ends are pinched off, the ripening will take place much earlier.

14. *For what Reasons do the White and Dottato Figs Carry their Fruits Better than the Others?*—On this occasion an important question ought, if possible, to be decided, that is, whether these figs are true species distinct from each other and from all others, or whether all the domestic figs are but varieties of one species. If we could decide for the first alternative,

there would be no need of further argument, as it is natural that different species distinguished by external characters should also have different constitutions. But I will admit, although I am not convinced, that all our figs are varieties of one species. The varieties raised from seed are numerous, and in some plants infinite in some respects; but that which has now to be noticed as more especially relevant to the present question is, that sometimes the constitution is altered, so that some varieties arise which feel certain influences more or less than the natural or primitive type from whence they proceed, for in a wood of chestnuts or oaks we often see variations from one individual to another. By this I mean to say that the White and the Dottato figs, whether you consider them as species or as mere varieties, cannot be denied to have been endowed by nature with a power of carrying nearly all their fruits. But difference in habit, however slight, is usually indicated by external characters or signs; and these, caused themselves by the diversity of habit, are again the causes of other differences. So the White and the Dottato figs are the strongest and most vigorous of all those to be found in the neighborhood of Naples, and thrive in any soil. Their leaves are large, not much divided, coarse, especially those of the Dottato, and support well the vicissitudes of the seasons; and the leaf is the mother and nurse of the fruit. Vegetation in these varieties usually proceeds regularly, as they shoot in March. They set no early flowers, and the shoots are not slender, unequal, nor attenuated, but thicken and lengthen moderately; the fruits grow regularly from the base upwards, and in the order of their age; they are, moreover, of a fair size, well proportioned, and, though not few in numbers, are not crowded so as to interfere with each other's nutriment. All these circumstances together produce, according to my opinion, the above effect; and the proof is clear on seeing what are the effects produced when, from the vicissitudes of the season or other causes, the leaves suffer; or when, the sap being irregularly distributed, the branches lengthen moderately, and produce a great deal of wood. Then the trees lose many fruits, but always less than other varieties, being supported by their intrinsic qualities.

15. *For what Reason does the Lardaro Fig Lose the Greater Part of its Fruits?*—The circumstances stated under the last two heads explain readily the cause of the Lardaro. This variety, though coarse in appearance, suffers by nature much from changes in temperature and from moisture in the atmosphere; and if the moisture is combined with heat, it causes it to throw out a great deal of wood. It produces a good many early figs, which I have never seen ripen, although they often attain a considerable size. The leaves are deeply divided, the vegetation of the branches unequal, and without order—here and there coarse shoots, which grow in a short time to a considerable length, with twenty or thirty eyes; and whilst in other figs at the end of August the shoots often cease to grow, or lose much of their vigor, those of the Lardaro continue to lengthen through September, and not infrequently through a good part of October, having always figs in the axils of the leaves. These fruits are very numerous, and many of them ill-shapen, distorted, lumpy, and of irregular growth, often two of different ages in each axil. In such a disorderly activity of vegetation, with such a number of fruits of different sizes and forms, with so much sensibility to atmospheric influences, it is not a matter of surprise that this fig should promise much and perform little, when we see that one only of the



above-mentioned causes will produce the effect; for we have stated already that the Sarnese and Chiaja figs lose a part of their fruits from producing too many. Meanwhile, I have not been able to correct the defect of the Lardaro by pruning, nor by leaving uncultivated the ground where it is growing; for that has appeared always to give it new strength to replace its pruned top, and throw out coarse shoots and make wood. Age, alone, and the enfeeblement of decay tames it, and then its branches, growing little and becoming less disorderly, preserve their fruits better. The difference may be observed, also, among the branches of one tree; and this to such a degree that whoever makes comparative observations on different individuals of this variety, sees that by diversity of age, soil, exposition, disturbed vegetation, or seasons, they vary so much that he cannot easily follow the thread of explanation. But, essentially, the facts are the same as those observed in other trees—that is, that vigorously growing individuals produce little fruit, and, like coarse branches, only make wood; that those which produce an inordinate quantity lose a good portion, and that generally a scanty crop follows an abundant crop.

16. *Effects of Grafting.*—After so many experiments had proved the nullity of any supposed effects of the fly on the domestic fig in making it retain its fruits, I one day, in the village of Ischia, came upon a Colombro fig, which seemed to show the advantage of caprification in a way to turn one's brain. It was in the center of an airy, open garden, with a good soil, situated in a flat, and far from the sea, a large and beautiful Colombro fig, with a handsome, well-formed head, the bark uninjured, the wood everywhere sound, and of a vigor and health without equal. From its foot arose a fine, large caprifig, its boughs intermingling with those of the Colombro. This tree, which had ripened its early figs, had, towards the middle of August, an abundance of the late crop, almost all with the fly withinside, firmly attached, and many approaching towards maturity. At some distance were other trees of the same fig, some with few, some with many of the late fruits, but none which approached in beauty to the other.

The circumstance of its having ripened two good crops, which, in the Colombro, so rarely happens, induced me to try and ascertain the cause. In the first place, I thought of the strength and vigor of the tree, the moderate and regular growth of its branches, the fact of its being at such a distance from the sea as not to be affected by its breezes, and the fertility of the soil, all of which together might account for the abundance of fruit. But, after some consideration, I did not feel satisfied, and had the tree cleared at its base to ascertain whether these two trees of different natures might not be naturally united, or, as cultivators term it, grafted by approximation. I found that such was the case; and further, that the two were both united in the same manner just below the surface of the soil with a Dottato fig, a few of whose suckers grew up at a little distance.

Here were two subjects of consideration suggested: first, whether, among the various effects of the stock upon the graft in influencing the abundance of size of the fruits, a similar effect might be produced by the above-mentioned intergrafting of three different things. The second point appeared to me of more importance. The vegetation of the domestic fig, by the effect of atmospheric vicissitudes, never flags nor rests, at least sensibly, from spring to autumn, whether with the growth of the

branches or of the fruits; but that of the caprifig rests a little after having produced the first crop, so that when these are ripening in June or July, the young ones of the next crop are not yet appearing on the new branches, whilst those of the domestic fig are a month old, and in full growth. Such being the case, where the stems of a Colombro and a caprifig are united, and both together grafted on a Dottato, it must be admitted, in the first place, that the roots are sufficient for all three; and, as between two trees joined at the base, the sap must pass more or less readily from the one to the other, and as the periods of vegetation of the two do not precisely agree in the present case, who would not see that the Colombro fig, forming its second crop whilst the caprifig is at rest, must receive the greater part of that which is absorbed by so many roots, and perhaps even a little of the sap of the caprifig itself? But leaving conjectures, which, indeed, are neither strange nor new, on the effects of grafting, let us return to facts easily appreciated by the senses. If the Colombro fig above mentioned bore so large a crop of fruits, not by the effect of the graft, but merely by having its boughs intermingled with those of the caprifig, the same effect ought to be produced where they are so placed without being united. And so I have seen it at Baja, but without the Colombro having, on that account, any more fruits than others far from the caprifig.

And I may now declare, that after many years' researches, and following up all the accounts and stories of cultivators, it has never happened to me to hear of any fact, however strange, new, or singular, on this subject, that might not be accounted for otherwise than by the effects of the insect.

17. *What Account should be Taken of the Maxims and Experience of Cultivators on Caprifigation?*—From all that is stated under the preceding heads, I should place no certain reliance on comparative observations made by the lower orders on two trees, one caprifiged and the other not, to observe the differences. For as differences in humidity, heat, rain, atmospheric influences, soil, etc., often occur, that which you may have thought you have ascertained one year will turn out quite different another. Above all, a frequent cause of error with us is, that two trees, believed to be individuals of one variety, are, in fact, two distinct varieties raised from seed, but so near to each other that cultivators do not perceive the differences. Varieties from seed have no limits in certain plants, and are produced in such numbers that often they may not be distinguished at first sight by external signs, and often these differences are only in the constitution, as, for example, in the horse-chestnut, the seeds of which, taken from one tree, will produce a hundred individuals, which may be all alike in all their parts, raised on the same soil, with the same exposure, and yet many of them differing from the others in the number of fruits they bear in proportion to their vigor, in their size, in the periods of their budding and flowering; and that happens often to certain figs which spring up everywhere about us from seed. Thus, in the commencement of my researches, I was often deceived, believing two trees to belong to one variety, when, after a time, I ascertained that they were distinct varieties; and this happens more frequently to those races to which the caprifig is given, that is to say, to the Lardaro, the Chiaja, and the Sarnese, which partake much of the wild nature, and for that reason bear so much fruit.

I have often discussed the subject with cultivators well informed, but

preoccupied with the idea of caprification. To every contradiction of mine they put forward that the experience of many years had proved to them the importance of it. Sometimes we came to the proof. When I showed them fruits not caprifigged ripening at the same time as others that were caprifigged, the most sensible of them replied that that depended on the soil, but that did not affect the property the insect has of making those fruits into which it penetrates set and ripen early. If, then, I showed them the number of fruits fallen from a caprifigged and non-caprifigged tree, they always claimed the advantage; and if I said that the same fig, as the Sarnese, for instance, ripened at Ischia abundantly without the caprifig, they said that depended on the soil and on habit. Our cultivators hold it for a maxim that if a fig has once had the caprifig applied, even the White fig, which in their opinion does not require it, it feels ever after the influence; and as if having once tasted of it gets a bad habit, will the following year only produce few fruits without the caprifig. Besides, seeing the insect with so much industry and ardor work its way from scale to scale into the inside of the fig cannot, in their opinion, but produce some effect. With such and similar matter it will be admitted that I may be quite satisfied.

18. *Conclusions.*—From the facts above stated it appears clearly:

1. That to understand well the effects of caprification, it is in the first instance necessary to know the nature of the fig and of the caprifig, and what connection they have with each other. And we have seen that the caprifig is not the male of the fig, as has been hitherto believed, but a species so different from it that it may well be taken as the type of a distinct genus.

2. The structure of domestic figs, as well of those to which the caprifig is applied as of others, is perfectly similar in so far as concerns the organs of the flower, the structure of the seed, and of the receptacle; so that it does not appear how the insect of the caprifig can be necessary to some varieties only.

3. And we have seen by experiment that the insect neither hastens the maturity nor causes the fruit to set, whether of early or late figs, nor yet is it necessary for fecundation.

4. That the circumstance of the caprifig losing early many of the fruits in which the fly has not been bred, does not serve to prove the necessity of caprification, but rather to refute the doctrine completely, as the fly does not breed in the domestic fig; and besides, we have seen that when the caprifig bears a large crop of fruits, many of them fall unripe, even though the insect has been in it, and the grub be found in the ovaries.

5. And in respect of the caducity of the fruits of some figs, the causes must be sought for chiefly in the constitution and mode of vegetation of those varieties; and also in the soil, climate, and vicissitudes of the season.

6. That thus caprification is useless for the setting and ripening of fruit, and therefore this custom, which entails expense and deteriorates the flavor of the fig, ought to be abolished from our agriculture.

19. *Conjectures on the Origin of Caprification.*—Having now reached the term of my labors, I cannot conceal a certain anxiety which has secretly grown up in my mind. I fancy I hear from all quarters that the custom of caprification being of such ancient date, and having been upheld by so many distinguished men of science, both ancient and

modern, cannot but be founded on experience, against which no theories, no subtleties of science, are of any avail. Verily does the rise of such ideas in my breast so agitate me, that many times in the midst of my labors my breath has been stopped by the fear that some fact illy understood has drawn a veil over my mind. Nor should I ever have ventured to publish this treatise were it not that I thought some consideration was due to the labor I had bestowed on it. Where the love for a subject induces one to undertake a work, the work itself increases that love. Besides there is the hope that, if not the whole, some part of it, at least, may prove useful to science. Of this it behooves others than myself to judge.

But independently of all such considerations, I may, in courtesy, be allowed some conjectures on the origin of caprifigation, and how it has become spread among us. The time when it began is entirely unknown, for the first record of it is in Herodotus, who lays it down as a proof of the dependence of the female date on the male, as of the fig on the caprifig. Certainly experience proved to cultivators the case of the date tree. Experience, therefore, many would say, proved to the Greeks the necessity of the caprifig for the fig. But it is not everything which our ancestors have handed down to us, by history or by popular tradition, that has been proved by experience, and often has analogy been confounded with experience. Let us suppose that the case of the date tree was first known, and that some one observing the caprifig, with its coarse, wild aspect, and with its fruits not good to eat, containing the fly withinside, should have conceived the idea that it was necessary for fertilizing the fig; this would not have been a demonstration, indeed, but a plausible supposition. And how many theories are there not built upon a few facts generalized by conjecture, analogies, and possibilities? These theories, in course of time, are proved or refuted, and often last a long time in spite of refutation, so difficult is it to turn the mind away from strong impressions and preoccupations, and to turn it away from habit; and habit is of such force that it becomes a second nature, as the old and popular saying has it. And when a maxim is once taught to the lower orders, especially to those living in the country, who are more tenacious of their habits and customs, every one knows how difficult it is to get the better of it, especially when it is connected with the hope or possibility of gain, and is ancient. Now, who can say that the custom of caprifigation did not rise and spread amongst cultivators in some such way? And habit is so great in this class of persons, that often they will not see their own loss and the gain of others, preferring to die in their errors rather than better themselves by the example of others.

Certain facts, either at first inexplicable or marvelous in appearance, have often given rise to popular opinion, which, from the remotest antiquity, have come down to us from generation to generation. Certainly, from the sight of the moon springs up at once the desire to know its properties; and at its brilliant and even marvelous aspect every one is naturally disposed to grant to it a large influence over the things of this world; and cultivators of old consult its phases for the periods of confiding seeds to the earth, or felling trees; from that body, in short, they deduce either the probability or the certainty of good or evil. I myself have no experience on the influence of the moon; but I believe that among popular credences, supposing them not to be all erroneous, none are more so than this on seed sowing. In vain, however, would it be to tell the cultivators of their error; all with one voice cry you down

with *experience*, and you must be silent. Experience being the sensible ground for reasoning on phenomena, there is no appeal against it; and however great and numerous the proofs you have to the contrary, the general opinion, resolutely maintained, at length puts you to silence. But the case of the moon, you say, has nothing to do with caprification. But do you believe, that on seeing for the first time the different kinds of receptacles of the caprifig, the insect propagated within them, this same insect afterwards issuing forth and penetrating into the domestic fig, forcing its way from scale to scale of the mouth, in a manner which one would have been at a loss to imagine—do you believe, I repeat, that this fact would not suggest to your mind some great design of nature to be fulfilled? And this was observed by the ancient Greeks, a people of lively imagination, who in all natural phenomena, in many plants and flowers, saw secrets, and wonders, and records, and living signs of human affairs.

It is certain that the practice of caprification came to us from Greece, if we give faith to Pliny, who says that in his time it was in use in the islands of the Archipelago, and entirely unknown to the Italians; but at what precise time it was imported I am unable to say. Writers on rustic affairs in the thirteenth century speak of it as a thing practiced in some places, and they then knew not how it came amongst us. What appears to me to be interesting is, that it was adopted by us precisely as the ancients had it—the opinions of our cultivators being the same as those of the Greeks as to its utility. Among country people the most remote traditions are perpetuated without any alteration of consequence. We read, for instance, in Dioscorides, that the mandrake has secret virtues, and that it is used by witches. Now, in some parts of our country, where the plant is common, the same opinions are held of it. As I was wandering one day about some fig grounds near Naples, I observed suspended to some fig trees some of those spongy excrescences found on elm trees, and occasioned by some aphid or pulex for the purpose of propagating within it. Having asked what was the use of it, I was answered by the cultivator that those spongy excrescences were as good as the caprifig to make figs set in abundance, and that he had been taught the recipe by his father, who had proved it, and his own experience had confirmed the advantage of it. This is, without doubt, an absurdity, yet the same thing may be read in Theophrastus; and afterwards Palladio, in his chapter on the fig, says: “And if there is none of this” (*i. e.*, of the caprifig), “a branch of wormwood may be suspended, or the excrescences which are found among the foliage of the elm.” Such is one of the numerous examples of ridiculous and strange practices in use among the lower orders from the remotest periods; however contrary to reason, they remain in vogue, and those who believe in them and practice them allege experience in justification. Certainly, as we have already said, experience is the groundwork of all sound reasoning or phenomena, and we ought on every occasion to follow it; but in speaking of experience, we must know by whom and in what times it was had.

Returning to caprification, from which we have somewhat diverged, neither its antiquity nor the experience of cultivators are of any account. I do not wish to disparage the labors of so many great men who have written upon it, but I only say they made no experiments; the ancients, like Aristotle and Theophrastus, relating what was the practice, and Cavolini and Galesio preoccupied with Linnæus’ opinion.

ABSTRACT









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