

annual, or at most biennial character. Although distributed over the whole of Europe and Northern Africa (Egypt), its original plant may be sought for with less probability of success in the Mediterranean than in India, where *Cichorium cosnia*, Ham., is certainly the same plant, and met with about Patna and Kamaon, as well as in Nepal, growing wild. The varieties *divaricata*, *humilis*, and *nana* may be considered as the result of cultivation.

This plant, unknown to the early Greeks, is at present cultivated and eaten in Greece. The young shoots, as well as the leaves, are boiled and eaten with vinegar.

The chicory (*Cichorium intybus*, L., *κχωριον* of Theophrastus) is a plant of as wide or even wider distribution than that just mentioned. The young leaves are used as food. Here and there only it is cultivated largely on account of its root, as, for instance, in Egypt, probably as far back as the time of Pliny. The dried root is frequently used in France and Germany as a substitute for or addition to coffee.

The samphire (*Crithmum maritimum*, L.) is a salad plant much prized in the entire East, as well as in Greece. It is cooked and used in sea voyages as an anti-scorbutic. Dioscorides mentions a *κριθμον*. Whether this plant is the above-named wild plant, or, as Landerer supposes, the latter is rather the *κράμβη θαλασσια* of Dioscorides, I will not here attempt to decide. Grecian fable narrates that the *Krambe* arose from the tears which Lycurgus, priest of Jupiter, shed when he beheld his slain child.

Bunias Erucago, L., *Senebiera coronopus*, Poir., and *Senebiera nilotica*, D C., are of less value. The first is used by the poor in Italy, the second in England, and the third in Egypt.

We may here mention a few plants allied to the above, such as *Zillia myagroides*, Forsk., (*Bunias spinosa*, L.), *Crambe maritima*, L., and *Crambe tataria*, Jacq. The former, occurring in the deserts of Egypt, furnishes only a poor dish on account of its spiny leaves, though it is used by the Arabians for lack of something better.

Crambe maritima, L., (*Sea kail*), growing upon the sandy shores of the East and North sea, and the Atlantic ocean, and of the Mediterranean sea, is more fitted for the purposes of nutriment. Even this, however, by the ancient Romans, was considered an indifferent article of food. When cultivated, and the young shoots are protected against the sun, it is like asparagus, and quite as good as this or cauliflower. The plant is chiefly cultivated in England.

Crambia tataria, Jacq., is a plant of the steppes of the region along the Lower Danube, Dnieper, and the Don. The root is fleshy and sweet, the thickness of a man's arm. It is eaten raw as a salad in Hungary as well as cooked, the same is the case with the young shoots of the stem. It is called *Tatar kenyer* (*Panis tataricus*), probably, because the Hungarians became acquainted with it in Tartary. In time of famine, it is used as bread in Hungary. It is probable that it was the *Chara caesaris* which the soldiers of Julius Caesar used for bread.

The spinach (*Spinacia oleracea*, L.), a much-esteemed green vegetable, is probably native in the regions between Caucasus and the Persian Gulf, as also another species of the genus, *Spinacia tetrandria*.

The cultivation of this plant in Persia and Arabia, undoubtedly took place in the time of the Romans, and it was thence distributed over Europe and Eastern Asia. The Arabian name for spinach is *Is-fânâdsch*, the Persian *Ispanj*, the Hindostan *Isfany*. Neither the Greeks nor Romans were acquainted with it. The Dutch spinach (*Spinacia glabra*, Mill.), is a variety of the common kind, produced in the course of cultivation. Of less importance are the green plants of the *Portulacca*, and numerous species of dock, such as *Rumex scutatus*, L., *R. acetosa*, L., and *R. patientia*, L.

The *Portulacca* or Purslane (*Portulacca deracea*, L.), the *ανδράχνη* of Theophrastus and Dioscorides, is a very widely distributed plant of the Mediterranean, occurring everywhere, and readily entering the loose soil of the gardens. According to Landerer, it is used as a salad in Greece, with oil and vinegar, and is also kept for a longer period in salt-water and vinegar.

A much more extended use is made of a species of Purslane, the *Lewisia rediviva*, Pursh., growing in North America. This plant, which occurs in great abundance on the western side of the Rocky mountains, especially in the valley of Columbia, is collected by the natives, who carry its dried root with them on their wanderings, and use it cooked like arrow-root to very great advantage. A man in full health and vigor can be supported merely by the daily use of not more than two or three ounces.

The Canadian hunters and servants of the Hudsons' Bay Company, have long since learnt its use from the natives. (W. J. Hooker, Bot. Miscellany, vol. 1, p. 344.)

The different species of dock, rich in oxalate of lime, and therefore of an acid taste, are entirely wild plants raised here and there in gardens. The longest known, perhaps, is the common garden dock, *Rumex patientia*, L., which Pliny designated *Rumex sativus*; at the present day *R. scutatus* and *R. acetosa*, are more used than the first mentioned.

Here also may be mentioned the borage, (*Borago officinalis*), which is characterized by the possession of a great amount of acetic, sulphuric, and nitric phosphoric salts, as well as of chloride of potassium, and, therefore, frequently used as a salad. The plant, native to the east, has been distributed throughout the whole of southern and middle Europe, even in the humblest gardens. It is also cultivated in North America and Chile.

The leaves of certain species of *Oxalis* furnish similar sourish, edible dishes, such as *Oxalis cernua*, Thunb., from the Cape of Good Hope, *Oxalis plumieri*, Jacq., from the Antilles, and *Oxalis zonata*, DC., in South Africa, cultivated at the present day in Belgium; *Oxalis crassicaulis*, Zucc., (*O. arracaha*, Don.), already mentioned on account of its nutritious tubers, and *Oxalis esculenta*, Hort. Berol., furnish an excellent dish from their leaves.

The *Corchorus* (*Corchorus olitorius*, L.) is a plant of the kitchen garden, the leaves of which are cooked like our spinach, and serve for food in the tropical regions of the earth. It is cultivated throughout the whole of Egypt to Cordova.

Other species of *Corchorus*, such as *C. tridens*, L., *C. acutangulus*,

Lam., *C. fruticulosus*, Vis., native in Sennaar and Cordova, are there used, as well as *Corchorus oltorius*.

There are still some other plants to be mentioned, which, although for the most part growing wild, or partly cultivated, are used as vegetables. Among these belong *Spilanthus oleraceus*, L., eaten as a salad on the Mascarenhas, in the East Indies, and South America, and called the cress, of Para, as well as *Spilanthus brasiliensis*, Speg., applied to a similar purpose in Brazil.

A few *Cichoraceæ*, such as *Tragopogon porrifolius*, L., *Tr. pratensis*, L., *Leontodon taraxacum*, L. (dandelion), *Sonchus oleraceus*, L., &c., are hardly worth mentioning here, though their leaves are used, both raw and cooked, as greens. The latter is eaten as a salad in New Zealand and on the Friendly Islands.

The field or *Rapunsel* salad (*Valerianella oltoria*, Mönch,) is well known throughout the whole of Germany.

New Zealand has its spinach plant in *Tetragonia expansa*, Murr., which is not only distributed over the entire archipelago of the Pacific ocean and Japan, but has also been introduced into Europe. A second species, *Tetragonia halimifolia*, Forst., which is as good as the first, is, nevertheless, not used in New Zealand as on Tongatabu.

A good many acid vegetables are used as salad, as well as the sweetish and bitter-sweet. Among these belong some species of *Ranunculus* and the plants known as cresses in Europe and other parts of the world.

Besides the young leaves of *Ranunculus ficaria*, L., which are eaten here and there in Europe, another species of *Ranunculus* is brought to market in north Persia, *Ranunculus (Ficaria) edulis*, Boiss. It is called *morch-serdag* (egg yolk), on account of the yellow color of its flowers. The small tubers, together with the young stems and leaves of the olossoms, serve as food. With these, according to Th. Kotschy, there appears in the bazar in Teheran, as a vegetable, the *Uolag* of the Persians (*Allium latifolium*, Jaub. and Spach.) This grows on the Alps. The whole of the young plant is considered a delicacy, and is used as an addition to rice (in a pilau.) *Urtica dioica*, L., is used by the Northern Persians, as well as by the Europeans. The best known cress is the garden cress (*Lepidium sativum*, L.), which, originating in the East and Egypt, is cultivated in Europe. It is mentioned by Dioscorides under the name of *Κάρδαμον*. *Lepidium oleraceum*, Forst., is used in New Zealand as a spinach, particularly by seafarers, while *Lepidium piscidium*, Forst., of the lower oceanic islands is useless as food, on account of the great sharpness of the leaves, although it is employed in the capture of fish. *Iberis nudicaulis*, L., and *Cochlearia danica*, L., with the garden cresses, are similarly employed.

To these we may add the native *Cardamine amara*, L., and *C. pratensis*, L., as well as *C. nasturtioides*, Bertero, in Chile. *Nasturtium officinale*, R. Br., is much esteemed in France. It loses its bitter taste by cultivation. The Indian cress (*Nasturtium indicum*, D.) has also found its way into the gardens of France. Other cresses are furnished by *Tropaeolum majus*, L., and *Tr. minus*, L., from Peru, as also by *Chimocarpus pentaphyllus*, Don, (*Tropaeolum pentaphyllum*, Lam.), in Brazil and Chile.

The *Atripliceæ* and *Chenopodiceæ* are richer in esculent species than

the preceding. The *Orache* (*Atriplex hortensis*, L.), which is native in Tartary, has long ago been introduced as a kitchen vegetable in Europe, and has already, here and there, run wild. It was known to the Greeks as *Ατράφαξις* (Dioscorides). *Theligonum cynocrambe*, L., (*Κοροράμνη*, Diosc.), indigenous to Europe, is also used here and there as a vegetable. The same is the case with *Chenopodium album*, L., *Ch. viride*, L., *Ch. hybridum*, L., *Ch. bonus henricus*, L., and *Ch. rubrum*, L.

The Strawberry spinach, or blite (*Blitum capitatum*, L., and *virgatum*, L.), is also more or less known. Even its insipid, strawberry-like fruit finds consumers.

Basella alba, L., is an East Indian spinach plant; and the roots of *Basella tuberosa*, H. B., serve as food in Colombia.

The species of *Amaranthus*, such as *Amaranthus ascendens*, Loisl., *A. prostratus*, Balb., and *A. sylvestris*, Desf., are used among us, although *Amaranthus polygonoides*, Lin., in Further India, is used only by the poor people. The younger shoots of the hop (*Humulus lupulus*, L.), likewise have a very limited application.

Some other plants of the Oceanic Islands and New Holland may be mentioned, especially in the southern part of the latter (Victoria), which are used as an antiscorbutic spinach. Doctor Müller mentions the following: *Tetragonia inermis*, *Trigonella suavissima*, *Tetragonella implexicoma*, and several species of *Cardamine*, also *Nasturtium terrestre*, and *Laurentia spicata*. Forster refers to the use of *Dracena terminalis*, L., *Dracaena indivisa*, Forst., *Boerhavia erecta*, L., *Portulacca lutea*, Sol., and *Solanum viride*, Soland., upon the Society Islands and in New Zealand as kitchen vegetables.

The fruits of some of the *Solanaceæ* are of great importance as kitchen vegetables, especially the egg plant and the tomato plant. The former (*Solanum esculentum*, Dun.), (*S. melongena*, L., p. p.), is a plant of Southern Asia and the Indian Archipelago, of very ancient cultivation, although no longer met with there in a wild state. It came by way of the East to Europe, even in the time of the Romans, and has been distributed over its entire southern part. It is cultivated at the present day on the western coast of Africa and the Islands of Mauritius likewise, and has become an inhabitant of America since the eighteenth century.

To the Egg plant may be added the Tomato, (*Lycopersicum esculentum*, Mill.) which is certainly an American plant, like most of the species of *Lycopersicum*. Although cultivated at present in the East Indies, its cultivation there dates only from the discovery of America.

The names, *Mala peruviana* and *Pomi del peru*, indicate still more decidedly its trans-Atlantic origin, and it is very probable that this plant was cultivated in Mexico at a very early period. At the present day the wild, original plant has disappeared from America, and even the form found on the Gallapagos seems to be only a stunted cultivated plant.

Two other plants, which in all probability belong to the western hemisphere, must not be passed over, although they have there a quite limited culinary application, they are the well-known *Phytolacca decandria*, Lin. (Poke berry), and *Ph. esculenta*, Van Houtte. The

former, originally from North America, its probable native land, has been distributed throughout Mexico, Brazil, the Sandwich and Atlantic Islands, and the region of the Mediterranean, even to Switzerland. It is used at the present day as a vegetable in the United States, and its young shoots are considered almost equal to spinach. It is doubtful whether *Ph. esculenta* is originally from Mexico or the East Indies; and it is only in more modern times that its leaves have been used as a spinach. (A. Braun on *Phytolacca esculenta*, a new edible plant. *Verhand. Gartenbau-Vereins*, xxi, 1, 1852.)

In conclusion, I may mention Asparagus, the Artichoke and the Gondelia, several species of *Malvaceae*, the Caper, and the interesting Cabbage of Kerguelen's Land, and some other less known and less widely distributed vegetables.

There are several species of Asparagus belonging to the Mediterranean regions. Of these the true Asparagus (*Asparagus officinalis*, L.) furnishes a very excellent and much prized dish, and may, by cultivation, be brought to great perfection. It is a plant of the sea-shore and river-banks of Southern Europe, the Crimea, &c. It is not found either wild or cultivated in Greece. Only the young, juicy shoots are used, which, when cooked, are soft and sweetish, and have a characteristic taste from a peculiar principle, asparagin. It is raised extensively at the present day in North America.

The common Artichoke (*Cynara scolymus*, L.) is also a Mediterranean plant, and probably only a variety of *Cynara cardunculus*, L., produced by cultivation, which is native to the Mediterranean, the Islands of Greece, and to Sardinia. The *ακόλυμος* of Dioscorides is not this plant, but *Scolymus maculatus*, L., the young leaves of which, when cooked, serve as a vegetable. Only the undeveloped flower-head of the artichoke, especially its much thickened parts, is used, and it furnishes a much prized dish. This plant is only cultivated in Greece, although it is sometimes met with wild, escaped from gardens. The varieties produced by cultivation differ in having larger or smaller, round and oval, armed and unarmed heads.

Gondelia tournefortii, L., a thistle occurring abundantly in Palestine, is similar to the artichoke. The young plant, especially the thick stem, with the young and still undeveloped flower-heads, is brought to the market of Jerusalem under the name of *Cardi*, and sought after as a vegetable. (Kotschy.)

The unripe and still green capsule of the Okra (*Abelmoschus esculentus*, Guill. and Perrott, *Hibiscus esculentus*, L.) is rich in mucilage, and, therefore, very nutritious; when cooked, it is frequently used as a vegetable. It is native to tropical Africa, and has been distributed as a plant of cultivation from Chartum and Sennaar, and over Egypt to Palestine and Syria, and has become naturalized in America. Its Arabian name, according to Kotschy, is *Bamia*; the American, Gombo, Gobo, Ochro.

The unripe capsule of *Abelmoschus longifolius*, Medik, originally an American plant, at the present day replaces the preceding as an article of food in tropical Asia.

The flowers of *Abutilon esculentus*, St. Hil., (*Sida esculenta*, Steud.), which are used cooked in Brazil, are of less moment.

The following plants of the same family are used as vegetables in different places: *Hibiscus cannabinus*, L., of tropical Asia, at present cultivated in Senegal; *H. hirtus*, L., *H. micranthus*, L., *H. furcatus*, Roxb., and *H. radiatus*, Cav., used both in Bengal and the East Indies; *H. ficulneus*, L., cultivated in Egypt; *H. sabdariffa*, L., from Guinea, cultivated now in the East Indies and America; *H. digitatus*, Cav., from Guinea; and *H. maculatus*, Desf.

We may also mention here two other plants, *Malva verticillata*, L., in China, and *Malva rotundifolia*, L., used formerly as a vegetable in Europe, but at present more in China and Lower Egypt. Even Pythagoras thought much of this spinach; and among the Greeks, as well as among the Romans, it was at one time much esteemed. *Malve* and *Asphodell* were raised at Delos for the temple of Apollo, as a symbol of the first nourishment of man. At the present day the young shoots are used as a salad in Southern France and Italy.

Indifferent greens are furnished by the young shoots and leaves of some species of *Epilobium*, as *Epilobium angustifolium*, L., *Ep. latifolium*, L., *Ep. tetragonum*, L., &c., although sufficing for Northern Asia and Iceland. The same is the case in Iceland with the fleshy and saline leaves of *Arenaria peploides*, L., or Sandwort.

The preserved flower buds of the Caper bush (*Capparis spinosa*, L.) have received a wide distribution as a vegetable. It was known to the ancient Greeks, and the renowned Phyrne, at the first period of her residence in Athens, was a dealer in capers. The *Capparis herbacea*, Willd., and *C. rupestris*, Sibth. and Smith, are also used for the same purpose, as well as the *Spartium scoparium*, L., of Germany, and the *Zygophyllum fabago*, L., in Northern Africa and Syria.

In conclusion, I will mention a few other less widely distributed and little known green vegetables. Among these are *Euphorbia edulis*, Lour., of Cochin China; *E. pilulifera*, L., of the East Indies; *E. hirta*, L., *Plukenetia corniculata*, Sm., and *Apocynum indicum*, Lam., from the Moluccas; *Codiaeum chrysosticton*, Rumph., from Hither India; *Osyris japonica*, Thunb., from Japan. Also several species of *Cissus*, with their acid leaves, such as *Cissus latifolia*, Vahl., *C. quadrangularis*, L., and *C. crenata*, Vahl., of the East Indies; *C. rotundifolia*, Vahl., and *C. ternata*, Gmel., from Arabia; *Cleome cuneifolia*, Mühlb., and *Cl. speciosa*, H. B., the former of North, the latter of South America; *Gynandropsis pentaphylla*, DC., is used as a vegetable in the East and West Indies; *Cassia sophora*, L., and *Cassia esculenta*, Sweet, in Amboyna; *Bauhinia racemosa*, Vahl., in the East Indies; *B. lingua*, DC., on the Moluccas; *Trigonella esculenta*, Willd., in Bengal; and *Trygonella platycarpus*, L., in Siberia; *Bombax ceiba*, L., the Cotton tree, and *Bombax septenatum*, Jacq., of tropical America, and *Agave americana*, L., the leaves of which, when cooked, furnish a palatable and easily-digested food.

The cabbage of Kerguelen's Land (*Pringlea antiscorbutica*, R. Brown) is similar to our cabbage, in the shape and tendency of the leaves to form a head. It was first discovered by Cook, in his first voyage, and subsequently by Hooker, jr. It was found again in the Antarctic voyage of Captain Ross, and is used to great advantage as a pleasant anti-scorbutic by the sailors. It grows abundantly in every

part of the island to an elevation of one thousand four hundred feet, although particularly luxuriant and fitted for food as a sea-shore plant. The young leaves have the taste of cresses or mustard, only somewhat more pungent.

The preceding enumeration of nutrimentitious plants, which I have endeavored to make as complete as possible, omitting nothing of importance, will enable us to take a general survey of the vegetable substances used as food in different parts of the world. The number of different kinds of plants in this category amounts to nearly 800, which could be very considerably increased by adding those plants and vegetable substances which are only used here and there by man, and then chiefly when driven by hunger, such as the bark of trees, the acrid tubers and roots, the sprouts and leaves of various kinds of herbs, insipid and unpalatable fruits, &c., such, for instance, as the tubers of *Chaerophyllum bulbosum*, the plant of *Salicornia herbacea*, the fruits of the Haw, Bramble, and Sloe, of *Hippophaë rhamnoides*, the Beechnut, &c.

If we bear in mind, however, that we are far from being acquainted with all the nutritious vegetable substances which are, or may be, drawn by man into the circle of his domestic economy, we may estimate the entire number of such species of plants at 1,000. Now, allowing, on an average only 10 to 12 varieties of cultivation to each species, we will have 10,000 different kinds available for his wants.

If we follow still further the facts mentioned above in detail, it is evident, as we remarked at the beginning, that the nutritious plants were originally distributed over the whole earth, and that the western hemisphere, as well as the eastern, had its peculiar vegetable products at the service of mankind. It will, however, be seen that the distribution of nutritious plants is by no means uniform, but that, on the contrary, certain parts of the earth are particularly favored, while in others they occur but sparsely, and in many regions are almost entirely wanting. This must necessarily have influenced very much the distribution of the human race over the earth, and its increase and accumulation in particular regions.

If we investigate this condition of things still further, by marking down upon a map of the earth the different nutrimentitious plants in their original localities, or in the ideal central point of their distribution, and represent the different varieties by particular symbols, we will obtain a very intelligible idea of the primitive condition of things, from which many important conclusions may be deduced.

If we now compare the two hemispheres, eastern and western, together, it will be seen that the eastern has a great preponderance over the western, so much so that, with the addition of New Holland and the islands of the Pacific ocean, it contains almost three times as many nutritious plants as the western. The following table will elucidate this more clearly:

Comparative table of the richness of the eastern and western hemispheres in nutritious plants.

Nutritious plants.	Total number of nutritious plants.	Number of nutritious plants.		
		In the eastern hemisphere.	In the western hemisphere.	In both hemispheres.
Amylacea, (starch plants).....	237	191	45	1
Oleosa, (oil plants).....	94	49	45
Dulcia, (sugar plants).....	81	52	29
Acidula, (acid plants).....	213	151	62
Salina, (saline plants).....	145	122	23
Total.....	770	565	204	1

It is a remarkable fact, that nutritious plants are accumulated together in a linear direction, both upon the eastern as well as upon the western hemisphere. If we draw a line from the Moluccas to Ireland, by far the largest number and most important nutritious plants are seen to have originated along or in the direction of this line. Into this line fall the nutritious plants of the eastern archipelago, of Hither and Further India, of Nepal, Persia, Armenia, the Crimea, Greece, Italy, and Central Europe. The regions exterior to this belt of land furnish only a few species, and these mostly of little value, such as China, Japan, Central Asia, and the eastern and western coast lands of Africa. The coast of North Africa falls in part into this linear belt, ranging from southeast to northwest.

New Holland, New Guinea, &c., take their place as the most inhospitable portions of the earth.

The same law of distribution, although less prominently exhibited, exists in the western hemisphere. A similar line runs from Brazil, by way of Guyana, Peru, Ecuador, Central America, the West Indies, and Mexico, along which are accumulated by far the most important and influential nutritious plants. The species peculiar to North America, Chile, &c., are only of inconsiderable moment.

The result of our investigation is so remarkable that I cannot refrain from considering the *bromatorial* line as of the greatest importance in respect to the history of cultivation, and as a road which, while leading the wandering man along a sure path, renders it possible for him to accomplish the great problem of his existence here below; he advances towards greater perfection. In fact it is this and no other line, upon the extreme point of which the history of cultivation of the ancient world takes its starting point, and along which the nations penetrated victoriously, by degrees, into the heart of Europe.

How far this idea is to be applied to American humanity, I may not venture to assert, since at present only loose fragments are known to us

of the earlier history of cultivation in that country; nevertheless, such a connection with the line of vegetable nutriment seems to be clearly indicated.

By whatever path, and with whatever assistance, man may progress to a condition of high moral and physical development, this much is certain, that food, and particularly vegetable nutriment, must have the greatest influence upon the attainment of this great object.

ART OF GOVERNING THE SAP.

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Translated by C. A. Alexander, of Washington, from the "Journal Mensuel de l'Académie Nationale Agricole, Manufacturière, et Commerciale, Paris.]"

A cultivator who gives himself no concern about the circulation of the sap in vegetables is not more in his place in the midst of the fields, than an engineer of a locomotive would be in his, who knew nothing of the properties of steam. The rejoinder, it is true, may be made that ignorance of physiological laws is very pardonable in the cultivator, since men of science are by no means of accord with regard to the course of the sap. In effect they range themselves in two different camps, one admitting the descent of the sap, the others denying it; but what imports to us the divergence of their hypothesis, if, as far as practice is concerned, they correspond to observed facts, and terminate in the same results?

Now, this is precisely what happens. Both equally satisfy us, and if we here adopt the theory of the descent of the sap, it is because it is the most widely diffused, and for no other reason.

We say then, the roots take up the liquid manure, which becomes sap, and ascends through the body of the plant, chiefly through the alburnum, is retarded awhile in the upper part, becomes modified and thickened, and then descends from the top towards the roots, depositing in its passage a new layer of alburnum. It is the blood, the life of vegetables.

It is the sap which makes the wood and the leaf—which makes also the fruit; the wood and the leaf, when it circulates in abundance and with force; the fruit, when its circulation is slackened, whether naturally, or in consequence of the obstacles we oppose to it. Knowing this, we comprehend, of course, that the art of governing the sap is of the greatest consequence to the cultivator. According as he governs it well or ill, it will give good or bad results. The pruning of trees, grafting, the culture of pot herbs, as well as culture on a larger scale, are subordinated to this principle.

Have we not slayers of trees, who end by killing outright their most robust specimens without obtaining any thing from them, while the skillful orchardist rears and keeps them long in a bearing condition.

Have we not kitchen gardeners who, so to speak, do what they please with their herbs, while others succeed only by chance, and can never be sure of anything? Why is this? Because the one has learned to manage the sap, the others know nothing about it.

Here and there, in professional books, we are supplied with judicious indications, but the writers do not attach themselves sufficiently to those little practical details in which consists the skill of the cultivator, but which escape the attention of scientists.

Now these little details interest us most; they form the principal object of the present article.

Let us commence with trees. When we have to do with subjects which are too vigorous, giving every thing in wood and nothing in fruit, we naturally infer that there is excess of health, and that it is proper to proceed with them as we would with sterile animals; in other words, let blood and put them on diet. Every enfeebled or suffering tree, plant, or animal is determined to the reproduction of itself. Hence we deal roughly with our barren trees; we make them suffer in different ways. Some retrench the roots, and thus cut off a portion of the channels which receive and distribute the sap; some drive nails into the trunk; some make holes with the gimblet as physicians puncture with the lancet. So much for the violent means.

The cultivators of the new school, if we may be allowed the expression, have recourse to procedures less energetic in form, but quite as sure in the result. To make a tree bear they content themselves with binding down the branches, with compressing the boughs against a wall or stake, with pinching the extremities. All this is perfectly known, but the reason of these little operations, it appears to us, is not so clearly comprehended.

The explanation, in a few words, is this: When you bend a branch down, you strangle, to some extent, the sap-bearing vessels at the point of curvature, at the same time that you withdraw the branch from the vertical direction which is favorable to the motions of the sap. Thus, this nutritive liquid no longer circulates so freely; there is a retardation of the developing process, and hence a determination to reproduction, that is, to fructification. When you tighten a bough against an espalier, you necessarily crowd the young alburnum, and thus choke the channels of the sap, and hence the same effects. When you pinch the end of a leaf-bud, you equally interfere with the flow of the nutritive juices, and disturb the functions of the tree, causing the bud to develop into a spur, which will produce flower-buds the next season; or by destroying a considerable number of leaf-buds, and thus checking the normal vegetation, you produce the same result with the buds that are left. And, as by thus depriving it of sap, you may convert a leaf-bud into a flower-bud, since the flower is in some sort but an abortive leaf, you may equally, by furnishing too much sap to the flower-buds, develop them into wood and leaves.

Would you have a proof? Cut close a subject charged with shoots, and you will see the greater part of those shoots changed into sterile branches, instead of fruitful ones.

When you practice close trimming, that is, when you remove much wood, the roots of the tree continue to supply sap, as if they had still