

READING 19-1

Source: English translation of Theophrastus: *De causis plantarum* by Benedict Einarson and George K.K. Link. 1976. William Heinemann, London.

Theophrastus

The Modes of Propagation in Woody and Herbaceous Plants

We must study the modes of generation of these in the light of the same considerations, laying it down that the mode most common to all is generation from seed. Still here too several modes occur, and we must distinguish the groups as they touch on the groups that have been discussed.

So with the mode under discussion, generation from the root. Some not only send up shoots from the roots spontaneously, but are also propagated from these by growers, as bulbous plants and in general all with a thick and fleshy root. But no such root should also have a watery fluid, as turnip and radish, since these roots dry out easily and are too weak to survive. The root instead must either have several coats together with a certain viscosity (as in purse-tassel and squill), or else be quite succulent and with plenty of flesh (as in fresh sweet marjoram, narcissus and plants of the same kind). For only such roots as these can be planted and removed from their place. In these furthermore the survival of some is longer, of others shorter, the duration depending on the distinctive nature of each kind. Again, other roots send up a shoot when left in place (as roots of plants with an annual stem), but the root is too dry to do so when taken up (since we must suppose the same explanation to apply to these roots as applies to certain others).

Some can be planted and propagated both from a detached sucker and from their extremities. From a detached sucker grow cabbage and rue, and among the coronaries southernwood for example, bergamot mint and tufted thyme; and some of the same-rue and southernwood with some coronaries—also grow from the other parts. Indeed these last (at any rate), like ivy, have roots that come from their shoots and send them down at once, ivy being the plant which in general is best at living when cut off, both when it penetrates the trees themselves and when it is stuck in the ground and covered with earth.

Of vegetables basil does this best, for it will even grow from cuttings taken from the upper parts, in spite of being woody. It does so because it does not readily dry out; this is why it not only survives for a long time, but also sprouts again when cut back. Southernwood too is woody, but (like ivy) is protected by its close texture and pungency (for ivy too will grow—from a cutting stuck into the ground).

These then are common to a large number of plants.

We pass to forms of propagation that are both rare in occurrence and found in fewer plants.

In lily and rose even the split stem grows and sends out shoots. This is very similar to what happens with the olive and other trees that can grow from a cut piece of wood, and this is why these plants can come under the cause that was given and preserve their generative fluid and heat. It is moreover reasonable that the wood should be cut up and the stem split: a start can be made more rapidly and easily from a smaller and open piece, whereas a large and closed piece is not so readily affected and thus does not sprout so easily. [This is why garlic when planted is separated into its cloves and the lower roots and outer scales of onions are removed, since these furnish everything that interferes with propagation, what is not alive (as the withered parts of trees) interfering with what is. Now in the olive and myrtle one must not peel off the coating when one cuts the pieces of wood, since it seals off the piece and preserves the life; whereas we must do this with onion and garlic, because here we are not removing coats that are alive or that determine growth. Indeed if here too we should remove this sort of coating, we are told that the pieces will not sprout.]

The most distinctive mode of generation is that from exudations, as in the alexander, lily and a few others. It is however not unreasonable, but accords with generation from split stems: all that is needed is that the generative starting-point from this source as well should have been accumulated, since this kind of generation too is not without heat and fluid.

The explanation why sap and exudations are not generative in all must be referred to the reasons mentioned above and earlier, which explain why the stems too, and the roots too, are not generative. The fact

mentioned earlier is also reasonable, that the lesser plants too have several modes of generation, in so far as it is easier to generate less perfect plants than the rest, and a smaller starting-point is needed.

The characters, then, and the causes of the modes of generation from the parts are to be studied from this discussion. Indeed if anything has been omitted, it is not difficult to supply it and perceive the explanation.

Spontaneous Generation

Cases of spontaneous generation occur in the smaller plants (broadly speaking), especially in annuals and herbaceous plants. They nevertheless sometimes also occur in larger plants, either after spells of rain or when some other special condition has arisen in the air and the ground. For it is thus that silphium is said to have come up in Libya, when there had been a fall of rain described as “pitch-like” and thick, and the forest now existing there is said to have come from another such cause, not having existed before.

Rainy spells not only bring about certain cases of decomposition and alteration, the water penetrating far and wide, but they can also feed what is formed and make it grow larger, while the sun warms and dries it, this being also how most authorities account for the generation of animals as well.

False Spontaneous Generation: From Imported Seeds

And if the air too provides seeds which it carries down with the rain, as Anaxagoras says, the rainy spells will be all the more prolific, since they would then produce an additional set of starting-points possessing supplies of food. Rivers again and collections of water and streams bursting forth from the ground would do so too, importing from many sources seeds both of trees and of woody plants (which is why rivers that shift their course make many regions wooded that were unwooded before). These last forms of generation, however, would not appear to be spontaneous, but a kind of propagation by sowing seeds (as it were) or setting pieces in the ground.

False Spontaneous Generation: From Unnoticed Seeds

One might fancy that the generation of the fruitless trees is rather a spontaneous one, since these trees are neither set in the ground nor produced from seed, and it is a necessary consequence that they are produced spontaneously if they are not produced in either of these ways.

But perhaps it is not true, at least of the larger plants, that they bear no seed, the truth being that we fail to observe all the cases of growth from seed, as we said in the History of the willow and elm. Indeed among the smaller plants too we do not observe many cases of this among herbaceous plants, as we said of thyme and others, whose seeds are not evident to the eye, but evident in their effect, since the plant is produced by sowing the flowers. Further in trees too some seeds are hard to see and small in size, as in the cypress. For here the seed is not the entire ball-shaped fruit, but the thin and unsubstantial bran-like flake produced within it. It is these that flutter away when the balls split open. This is why an experienced person is needed to gather it, by his ability to observe the proper season and recognize the true seed.

Here then is one point, propagation from unnoticed seed, and it applies to many trees, especially those that succeed each other without a break in wild forests and on mountains, since the succession could not easily be maintained if the trees were formed spontaneously. Instead there are two alternatives: to come from a root or from seed.

On the other hand woodcutters report that among trees of the self-same (and not just of a similar) kind a few individuals are fruitless. Here it is likely that either the seed passes unnoticed or else that the tree becomes fruitless because it expends all its food on the other parts, as with vines that “get goatish” and other trees where this occurs. And when failure to bear is found in individuals of kinds that can or do bear fruit, what is to keep it from happening in whole kinds, which are maimed as it were in their capacity to engender fruit?

This however is to be taken as a mere opinion thrown in. We must examine the question more exactly and gather information about the cases of spontaneous generation. Broadly speaking it must occur, when

the earth is thoroughly warmed and the accumulated mixture is qualitatively altered by the sun, which is what we observe when animals are spontaneously formed.

Propagation in Another Tree: Grafting

It remains to discuss the cases where propagation occurs in other trees, namely in twig and bud-grafts. What we have to say is simple and has (so to speak) been said already. since the twig uses the stock as a cutting uses the earth. So bud-grafting too is a kind of planting, and not a mere juxtaposition; here however it is evident that what produces both the sprout and the fruit is the generative fluid the bud possesses this when it is fitted into the stock, and getting its food from the latter produces its own type of sprout.

All grafts grow rapidly because their food has already been worked up; and this applies still more to the bud-grafts, for their food is the purest and just as it is already in the fruits that are continuous with the stock. Like always coalesces readily with like, and the bud is as it were of the same variety.

It is also reasonable that grafts should best take hold when scion and stock have the same bark, for the change is smallest between trees of the same kind, and what occurs is as it were a mere shift in position.

For the impulse not only of the saps of the two but of the whole trees toward sprouting is then simultaneous, so that here, when graft and scion are like and have fruit with like responses, both circumstances make the rapidity of growth reasonable. In the rest the growth is more rapid as the difference in the kind of tree, the character of the sap and the seasons of development diminishes.

The seasons of grafting are also reasonable, or rather perhaps are necessarily the ones that they are, when all further sprouting in general takes place: autumn, spring and the rising of the dog-star; for we must take a graft that feels the urge to sprout. The arguments in favour of each season are much like the arguments in favour of each as a time for planting. Some persons recommend spring, the trees being still pregnant at the time of the vernal equinox, since the graft in that case will sprout at the time of the pregnancy, and meanwhile the bark grows over the graft and encloses it. Others recommend the season at the rising of Arcturus, for the graft at once "takes root" (as it were) and (as it were) "seals over;" and once it has coalesced with the stock it puts forth its sprouts all at once at the coming of spring, having as it does a more powerful basis to start from.

The advice to graft buds on the smoothest and youngest axils is also reasonable. For here the buds best take hold because of the smoothness and youth of the axils, since what is young is full of life and sprouts well.

The stocks best fitted for bud-grafting, to put it in a word, are those with a certain stickiness in their fluid; further, those with bark that is soft and of the same kind and that have similar responses (which is why the best bud-grafting is on stocks close to the bud in nature and age). For the stickiness also establishes a hold; and when the bark is soft and similar it favours the bud equally with the bud's own bark and makes the change no great one.

In the rest the time for grafting is short because of their rapid sprouting, but lasts longer for the olive, which keeps producing buds longer. Further we are told that the new wood produced in spring stays tender and has a flow of fluid throughout the period, and the site of the graft remains moist all summer; and that with these advantages the graft grows better than that of any other tree; since some suppose that all this keeps the graft steeped in fluid for as long as four or even five months.

Rain is harmful to a bud-graft, seeping in and decomposing it and killing it because of its weakness, and this is why it is considered safest to graft buds in the dog days, although nowadays some growers tie bark around the site to prevent rain from seeping in. For a twig-graft on the other hand rain is helpful if the graft is not naturally moist. This is why some growers plaster it with mud and others set a pot of water over it and let the water drip, in the belief that the wound is large enough for the scion to dry out quickly unless it gets fluid.

We are rightly told (1) to keep the bud and bark from getting torn and (2) to trim the insert in such a way that no core wood is exposed at the site; for when the bark is torn or the core exposed the scion dries out and perishes. This is why cultivators also first bandage the site with layers of lime bark and then plaster

mud over it mixed with hair: to make the fluid remain and keep sun, rain and cold from doing any harm. So too after slitting the stock and giving the scion a wedge-like shape a they drive it in with a mallet to make the fit as tight as possible.

There must also be no excess of their own fluid in the scions. This is why in the case of the vine scions are cut two days before grafting, to allow the exudation that collects at the cut first to run off and save the scion from decomposition and mould. On the other hand scions of the pomegranate and fig and of trees drier than these are grafted at once.

One must choose the proper seasons for grafting with both the country and the nature of the trees in view, since some combinations are too wet, others too dry. For thin soil spring is in fact the better season; for what makes this combination appropriate is that thin soil contains but little fluid. For rich and muddy soil on the other hand the better season is autumn, since in spring there is far too much wetness to preserve the graft so long as bleeding still persists. Some set this autumnal season at thirty days.

It is also reasonable that trees so grafted should bear finer fruit, especially when the scion is from a cultivated tree and the stock from a wild tree of the same bark, since the scion is better fed because the stock is strong (this is why it is recommended to plant wild olives first and later graft them with cultivated buds or twigs). For the grafts hold better to the stronger tree, and since this tree attracts more food they make it a finer producer. Indeed if one should reverse the procedure and graft wild scions on a cultivated stock, there would be a certain improvement in the wild crop but no fine fruit.

Let this suffice for the discussion of planting in the sense of grafting.