

How do you know? How many leaves grew on the main branch this year? Where? How many on the side branches? Fix upon any point where a side twig joins the main one. From this point to the end of the main twig is a much greater distance than to the end of the side one. Is this due to greater age or faster growth? How can you tell the age of a maple branch without cutting it off? If permitted to cut it off, could you tell its age in a different way? Try both ways, and see how they agree.

When the leaves fell this autumn, each left a scar. Examine this scar. What is its position relative to buds? Notice three dark spots on each leaf scar. Why should there be three? If you can find a horse-chestnut, examine its leaf scar for similar spots or dots. How many are there? What are these dots?

Furthermore, the bark of our maple twig is profusely dotted with white specks. What caused them? Are they as systematically arranged as leaf scars? Did insects make them? Are they on every maple twig? Look for them also on alder, birch, cherry, apple and other trees. Are they on young twigs of pine and spruce? If caused by insects, wouldn't an occasional tree be missed? Are these spots the same shape on the older part of the trunk of a birch as on the young branches? If insects caused them, why this difference of shape?

A comprehensive answer to these questions is, doubtless, desirable. In teaching this phase of the subject to your own classes, however, I should suggest that you let the children answer what they can from immediate observation; and then allow them a few days to think about the more difficult questions before you give them a final answer.

I have a twig of rock maple before me as I write. Will the reader see if what I say is also true of red maple? The latter flowers earlier in the spring. Possibly that is evident even in November by the larger buds. I notice that the main branch and each side branch end with three buds. The central one is larger than either of the other two. Next year, these will develop into branches, the largest bud becoming the largest branch. The two side buds being weaker, will usually give small side branches. Moreover, side branches, in general, will grow more slowly than the main branch on account of poorer light. The small side branches are the same age as the main branch, counting from the same point; for

the three were once buds together, just as three buds are now found together at the end of this year's growth. Furthermore, you can count the age of each by the groups of small rings on the bark—looking very much as if a very fine wire had been tightly wound round the twig four or five times, and then removed.

What made these rings? Carefully remove the scales from the terminal bud, and notice that their scars will leave similar rings on the green axis which will be the starting point of next year's growth. Then, these rings must be scale scars, and must mark the starting point of a certain year's growth.

It is interesting to note whether a certain twig has grown the same amount each year for the last five years. If not, why not? Look at other twigs. If all show a slow growth during a certain year, we must conclude that was an unfavorable season for growth. If only an occasional branch fails to grow, some local cause, such as injury or lack of light must be ascribed.

It often happens that certain buds do not grow. They are not always dead, however. Often they remain dormant for years; but finally get a chance to grow. Find a dormant bud on any tree you choose. Cut off the branch just above this bud. Possibly next year that bud will grow. It will get the nourishment that otherwise would have gone to the buds above it. This may explain why leaves will grow on the side of small shade trees when their tops are cut off.

Beneath each bud, you will find a leaf scar. We should expect this, for buds grow in the axils of leaves. The dots on the leaf scar are the ends of the fibro-vascular bundles, through which food travelled to and from the leaf. Read about fibro-vascular bundles in your textbook. A maple leaf has three main veins; and we notice three bundle-ends in its leaf scar. A horse-chestnut leaf usually has seven leaflets, with one main vein in each; and its scar has seven bundle-ends. Now look at the leaf scar of a birch. What do you find there? Write out in full what these observations teach.

Now, I have answered some of the foregoing questions. Others I leave. The teacher who tries to profit by this course will observe what I have mentioned, and possibly discover things I passed over. Those specks on the bark are called *lenticels*. I shall give you a month to read about them.