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## WINTER BUDS OF OHIO TREES AND SHRUBS.

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In a region where plants are exposed to severe winters and great variations of temperature, the development of proper protective devices for the delicate stem tips becomes of considerable importance. Winter buds are usually protected by various kinds of scales, by pubescence, or by gummy and resinous excretions. These devices are not developed to keep the tip warm nor to prevent freezing, but to check evaporation.

In cold weather, when the temperature of the cells is reduced to or below the freezing point, water is driven off and solidifies as ice crystals in the intercellular spaces, outside of the cell wall. Now, as is well known, if some frozen plants while thawing out are submerged in water only a few degrees above freezing, they may recover completely, because the normal turgidity of the cell is thus restored. In much the same way, if a frozen bud is properly protected by suitable coverings, when the ice melts the water will be retained and reabsorbed by the protoplasm of the cells, while if it were freely exposed the water would evaporate and the cells could not regain their normal condition since little or no water is being absorbed by the roots.

A very perfectly protected winter bud is found in *Platanus occidentalis*. After the protective cap, formed by the base of the petiole, falls away with the leaf, the bud is exposed for the first time since its inception. It is completely covered by a single smooth outer scale. Beneath this is a gummy layer and on the inside a large amount of dense coarse pubescence. One could hardly think of a more perfect arrangement for keeping in moisture.

Winter buds may be without definitely developed scales, as in *Asimina triloba*, *Hamamelis virginiana*, and *Rhus glabra*.

Such buds are said to be naked although usually well covered by a silky or felty pubescence. Among the conifers *Thuja occidentalis* and *Juniperus virginiana* have naked buds.

Our species of *Pinus*, *Abies*, *Tsuga*, and *Picea* and most of our woody dicotyls have scaly buds. The bud scales may be fleshy as in *Tilia americana* or more commonly dry, at least on the outside, as in *Fagus americana* and *Aesculus glabra*. The buds may be covered on the outside by a single scale, as in the various species of *Salix* and in *Platanus occidentalis*, or there may be several to many scales exposed. In *Fagus* and *Aesculus* the scales are imbricate and numerous while in *Liriodendron* and *Magnolia* they are connate and represent pairs of stipules.

The buds are sometimes prominently stalked, as in *Hamelis virginiana* and the various species of *Alnus*. In certain trees the buds are hidden under the leaf scar, as in *Robinia* and *Gleditsia*; in others they are minute and hidden under the short petiole bases, as in *Cornus florida* and in *Philadelphus*. In *Gymnocladus dioica* the buds are sunken and protected by a protuberance of the bark. The buds may be single in the axils, as in *Morus* and *Ulmus*, or there may be two or more in an axil. Frequently there are three side by side, as in *Amygdalus persica*, *Prunus serotina*, and *Acer rubrum*, and occasionally they are clustered. Quite frequently the buds are superposed. This is normally the case in *Juglans*, *Hicoria*, *Menispermum*, *Gymnocladus*, *Ptelea*, *Gleditsia* and *Cladrastis*. In *Quercus* the buds are prominently clustered at the tip of the twig.

In many trees and shrubs the terminal bud is self-pruned or withers away. This is the condition in *Morus*, *Ulmus*, *Diospyros*, *Tilia*, *Cercis*, *Staphylea*, and many other genera. In these plants the axillary bud or pair of buds near the morphological tip of the twig may be called end buds. In some species, as for example *Rhus glabra*, a considerable part of the end of the twig is deciduous. Plants with prominent terminal buds are the various species of *Fraxinus*, *Malus*, *Amygdalus*, *Juglans*, and *Hicoria*. In the genus *Prunus*, so far as the writer knows, all the cherries, both wild and cultivated, have terminal buds while the plums and apricots do not.

Winter buds may be of a reddish or violet color, as in *Tilia americana* and *Cercis canadensis*. They may be glabrous, as in *Liriodendron* and *Liquidambar*, or they may have various types of pubescence, as in *Populus alba*, *Sorbus aucuparia*, *Xanthoxylum americanum*, *Juglans cinerea*, and *Corylus americana*. Some buds are stellate pubescent, as in *Hicoria alba*, and others are prominently covered with peltate or scurfy scales, as in *Hicoria minima* and in *Lepargyrea*. Among our trees with gummy or resinous buds: *Aesculus hippocastanum*, *Populus balsamifera*, and *Populus deltoides* are prominent.

Finally some winter buds show a very distinct vernation—conduplicate, involute, revolute, plicate, or convolute—although this is usually well shown only while the leaves are expanding in the spring. The conduplicate vernation is very distinct in the winter buds of *Liriodendron tulipifera* and the involute arrangement in the buds of *Populus balsamifera*.

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