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Study of Glands in the Hop-Tree

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STUDY OF GLANDS IN THE HOP-TREE.

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In studying this plant, the main object has been to bring out the characteristics of the glandular structures in *Ptelea trifoliata* and the differences between the glandular structure of this plant and other used in a like way as the hop.

The hop-tree is grown quite extensively in parts of Russia, as a substitute for true hops. It has the same bitter taste, but is without the aromatic principle which makes the bitterness of true hops so valuable.

It is also used in bread making as a substitute for hops. It does the same thing without giving it exactly the same taste. In bread making it prevents the yeast from souring by checking the fermentation before all the sugar is converted into alcohol and carbon-dioxide.

The members of the order *Rutaceæ* are noted for the conspicuous aromatic properties, as in the prickly ash, Ruta, Dictamnus, orange, lemon, etc. They all have lysigenous passages. Ruta, so commonly cultivated in gardens, is very acrid, sometimes even blistering the skin, and this acrid substance is found in the numerous lysigneous passages produced in the plant.

The glands of Ruta are situated just under the epidermal cells. They are circular in outline, enclosed by layers of thin walled, more or less disorganized cells, followed by a layer of cells with granular contents.

The mode of origin of these glands is quite interesting, especially when compared with resin canals. DeBary and others, who have studied them, find their origin to be as follows.

They can be seen well in sections of young growing leaves of either *Ruta graveolens*, or another nearly related plant, *Dictamnus fraxinella*.

They appear as roundish spaces or cavities filled with their contents (formerly called interior glands), and are produced in

such a manner that the cells which occupy the place of the subsequent receptacle becomes filled at an early period with the respective secretion. Afterwards the membrane of these cells containing the secretion disappears.

DeBary states that in Dictamnus, beneath the epidermis, but derived in part from it, there arise cavities containing ethereal oil.

The presence of oil cavities is a general and characteristic phenomenon in members of the order *Rutaceæ*. In the stem of *Dictamnus* and *Correa* these cavities lie directly under the epidermis.

Their origin is in all cases lysigenetic. He refers to a description and drawing by Frank of *Ptelea trifoliata*. The oil glands of Citrus are located in the yellow part of the rind, sometimes extending into the white layer. They are large structures visible to the naked eye, the walls are composed of thin walled rectangular cells so arranged as to give the glands an oval appearance. In the very large oil spaces in the rind of the fruit of Citrus a solution of the cell walls is distinctly perceptible.

This is probably still more the case in trunks of Copaifera, in which the balsam passages attain an enormous development. These trees contain the Copaiva balsam in canals which are as much as an inch in diameter and which often traverses the entire trunks.

Hop-tree differs from most of these in that the cell contains one large oil globule and several smaller ones.

The resin of *Ptelea* is not soluble in cold water, but slightly so in warm water. It seems to dissolve in ether, but there remain small granules,

In alcohol the resin dissolves and the globules break up.

It is not soluble in glycerine. The common hop *(Humulus lupulus)* and hemp *(Cannabis sativa)*, although very different in structure, have similar resinous secretions.

The fruit of the hop as well as the axis and the base of all the leaf-like organs are beset with numerous shining translucent glands to which the aromatic smell and taste are due. Hops found in commerce consist entirely of fully developed cones, more or less compressed.

Each grain is originally attached by a very short stalk. The glands are short stalked, cupped plates of tissue, the cuticle of which is raised up by the bulky secretions, while the cells

die. Behrens has recently studied hops. According to him the formation of lupulin glands begin after complete development of the bracts, the ethereal oil is secreted between the cuticle and the cuticularized membrane. He further remarks that the quantity of lupulin grains is dependent upon fertilization. These glands serve as a protection from animals, and also that the only possible way of recognizing ripe hops is to find the lupulin grains filled with this lupulin.

It is gradually soluble by water, and instantly so by alcohol and ether.

The covering of the calyx has on it many glandular hairs which secrete the resin and oil.

Examined under the microscope it appears to be made up of minute transparent grains of brown resin agglutinated with short hairs of the plant.

EXPLANATION OF PLATE.

In Fig. I is shown one of the fruits of the *Ptelea trifoliata*. The glands appear as minute dots over the surface of the fruit, being more numerous directly over the seed.

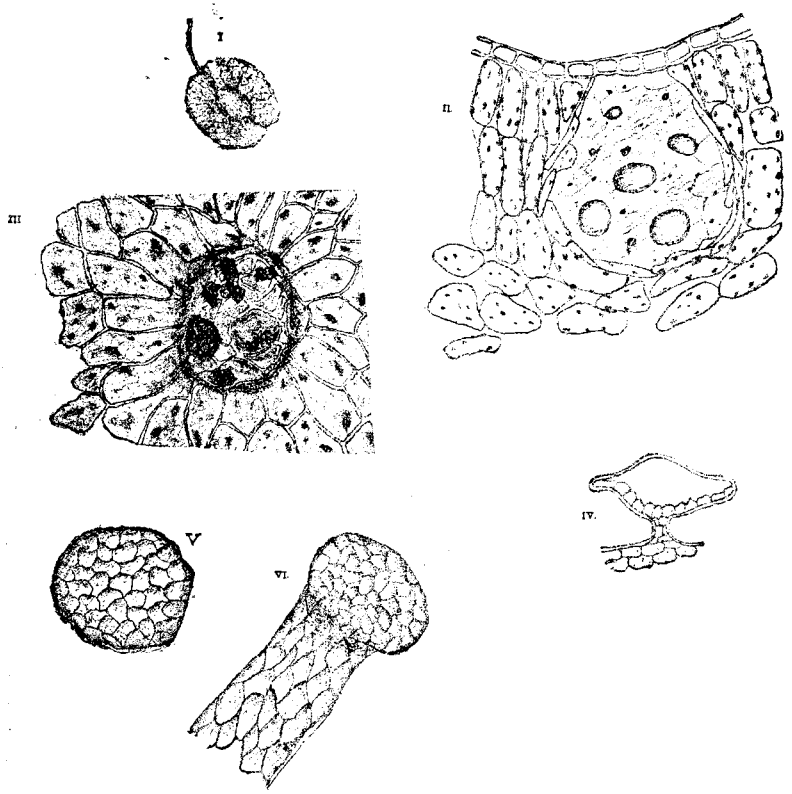
Fig. II is a cross-section of one of the glands of the fruit of *Ptelea trifoliata*, showing the resin and oil globules. The fragments of some of the cells may be seen around the edge of the gland. The gland occurs just beneath the epidermis.

Fig. III is a surface view of one of the glands of the fruit of *Ptelea trifoliata*. The resin and oil globules are shown surrounded by the regular cell structure.

Fig. IV is a cross-section of one of the glandular hairs on the fruit of true hops, *Humulus lupulus*.

Fig. V is a view from the top of one of the glandular hairs which occurs on the hemp, *Cannabis sativa*.

Fig. VI is lateral surface view of one of the glandular hairs which occurs on the hemp, *Cannabis sativa*.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