is somewhat opposed to the view of these tubes functioning as conductors of starch from the leaf.

In Section III reasons are given for thinking that in some caoutchouc trees the latex of the young stems and leaves differs in the composition of its globules in suspension from that of the trunk and main branches. While the latter yield rubber free of stickiness, the former give a somewhat viscous substance with feeble elasticity. Such is the case with *Hevea*, *Castilloa*, *Landolphia Kirkii*, *Ficus elastica*, and *Urceola esculenta*.

Section IV treats of an important fact connected with the tapping of *Hevea* trees, viz., that wounding the bark causes a greater flow of latex from subsequent injuries, a point first indicated in the experiments of Mr. Willis, who found that the weight of rubber obtained from the second tapping was about double that from the first. The author has followed this up with some instructive results.

In Section V a peculiarity in the exudation of latex from the severed base of the petiole of *Hevea brasiliensis* and *Plumiera acutifolia* is described and discussed.

In Section VI a special laticiferous system developed in the immature seed of *Hevea brasiliensis* is brought to notice.

The paper concludes with general remarks and suggestions on the origin and functions of laticiferous tissue.

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INTUMESCENCES OF HIBISCUS VITIFOLIUS (L.)[1].

I. *Anatomical Part.*

The plants on which the following observations were made, were grown, directly or indirectly, from seed from Somaliland. The intumescences, which vary in size and shape, occur on the leaves, stems, green parts of the flower, and on the young fruit. Some are entirely colourless; others are green at the base. Those on (1) the leaf differ from those on (2) the stem.

1. *On the leaf* the intumescences are of two types.

(α) Purely epidermal.

(β) Partly sub-epidermal.

[1] Abstract of paper read before the Botanical Section of the British Association, Dover, Sept. 1899.

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a. The purely epidermal and smaller type consists of one or two tiers of much elongated, thin-walled cells, usually twisted spirally round one another. At the apex is a stoma, which may or may not lead into an intercellular space.

β. The larger outgrowths contain basal prolongations of parenchyma.

2. *On the stem* the outgrowths are more complex, and usually larger. The basal part consists of elongated sub-epidermal cells divided by periclinal walls. The upper part is made up of much-enlarged, thin-walled epidermal cells, similarly divided. The outgrowths later become cut off by cork, which arises in the lowest row of daughter-cells derived from the original epidermis, i. e. in the lowest colourless cells; after suberization of these cells the outgrowth shrivels.

II. *Experimental Part.*

Seedlings were raised in the Tropical Pit, and eight of them were planted, each in a separate pot, and allowed to grow on under identical conditions. They all developed intumescences, and were all very much alike. When each had about nine or ten leaves, and was beginning to flower, the plants were placed under different conditions, and examined at the end of six weeks:—

The plant grown in the open was entirely free from intumescences; it was particularly vigorous, and had strong lateral branches.

The plant in the temperate house had outgrowths only on the *under* sides of the leaves, and on the flowers and fruits.

The plant in the filmy fern-house was very unhealthy, but had no outgrowths.

All the other plants had outgrowths on one or both sides of most of the leaves, on the stems, the green parts of the flowers, and on the young fruits.

Conclusions.

As far as the evidence goes at present, it seems to point to the conclusion that the intumescences are pathological, and are due neither to insects nor to fungi, but to the direct effects of environment. The formation of outgrowths appears to be caused by excessive moisture combined with a high temperature. If the temperature is low the plants do not appear to have strength to form them. The

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production of outgrowths seems to be a response on the part of the plant to insufficient transpiration.

Note.—Similar, but less well-marked, outgrowths were observed on the leaves of plants of *Ceratotheca triloba*. As in the case of *Hibiscus vitifolius*, they were not formed in a plant placed in the open ground.

Outgrowths which may prove to be of the nature of those in *Hibiscus vitifolius* have been described by Sorauer in *Dracaena* (*angustifolia*, &c.), *Cassia tomentosa*, *Acacia* (*semperflorens*, &c.).

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STEM-STRUCTURE IN SCHIZAEACEAE, GLEICHENIACEAE, AND HYMENOPHYLLACEAE[1].—There is a wide difference between the types of stem-structure shown by the different members of the *Schizaeaceae*[2]. Thus *Lygodium* has a stele in which the xylem forms a solid mass in the centre of the stem, and is surrounded by a continuous ring of phloem, pericycle, and endodermis.

Aneimia Phyllitidis, on the other hand, has a ring of separate bundles (or steles), which may be compared with those of *Aspidium* or other *Polypodiaceae*; each of them consisting of a band of xylem surrounded by a phloem, pericycle, and endodermis of its own.

Mohria resembles *Aneimia Phyllitidis* in type. Certain species of *Aneimia*, e.g. *A. mexicana*, have in the internodes a complete ring of xylem bounded on the inner and outer side by a ring of phloem, pericycle, and endodermis, with a central pith, and thus resemble *Marsilia*. *Schizaea* has a ring of xylem surrounding a central pith, but no internal phloem or endodermis.

The above four genera, which make up the *Schizaeaceae*, agree in having a stem-protoxylem, which is not well-marked, as it consists of elements which are not annular or spiral, and are usually not specially small. *Lygodium*, *Aneimia*, and *Mohria* are exarch; in *Schizaea*, however, the relative position of the protoxylem has not been made out with certainty.

In their main points the types of stem-structure found in the *Schizaeaceae* agree with the structures shown at successive levels in the stem of a 'seedling' plant of *Polypodium*, i. e. at successive stages

[1] Abstract of paper read before the Botanical Section of the British Association, Dover, Sept. 1899.

The main structural points in this Order and the *Hymenophyllaceae* are described by Prantl, Morphol. d. Gefässkrypt., 1, 1875, and 2, 1881, Leipzig.

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