be severe from the observation of the sun-spots."

A hasty survey of the literature concerning the occurrence of *Puccinia,* and brief correspondence or personal conferences with some of our American botanists failed to reveal any knowledge of this hypothesis, and although it is not probable that it is of any great importance, I thought it would be of sufficient interest to be placed on record in an American publication.

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SPECIAL ARTICLES

TIER-LIKE ARRANGEMENT OF THE ELEMENTS OF CERTAIN WOODS

THERE are numerous woods which present on longitudinal section (particularly the tangential) fine, delicate cross lines or stripes sometimes called "ripple marks." The distance between these markings varies from 0.11 to 0.50 mm., and is fairly constant for a species. On some woods (*e. g., Æsculus octandra* Marsh., *Swietenia mahagoni* Jacq., *Bombax insigne* Wall. and *Pterospermum diversifolium* Blume.) these lines are very clear and distinct to the unaided eye; on others (*e. g., Tilia americana* L., *T. pubescens* Ait., *Pterocarpus indicus* Willd. and *P. dalbergioides* Roxb.) they are near the limit of vision or again (*e. g., Guaiacum sanctum* L. and *G. officinale* L.) they are invisible without the lens. In most species showing these markings the feature is constant and of considerable importance for diagnostic purposes, though in a few species (*e. g., Swietenia mahagoni*) the same piece of wood may show the markings in one place and not in another.

This cross-striping of a wood is due (1) to the arrangement of the rays in horizontal series, or (2) to the tier-like ranking of the wood fibers, vessel segments or other elements, or (3) to a combination of (1) and (2). The lines resulting from the horizontal seriation of the rays is usually more conspicuous and of more common occurrence than those in (2). In the combination of the two forms, which is very common, the junction of the vessel segments or of the fibers is usually between the rays.

This peculiar arrangement of wood elements is also evidenced on transverse section. Where the rays are in perfect horizontal seriation a section between two tiers shows an entire absence of rays. In most instances, however, it results in gaps of irregular width depending upon the regularity of the stories. Where the rays are much wider near the middle than at the margin their apparent width when viewed transversely will show considerable variation, according to the relative location of the plane of section. Where the fibers are arranged in tiers their apparent size is affected in a similar manner. According to von Höhnel[1] the fibers in *Bocoa provacensis* Aubl., and a few other tropical woods with cross-striping are also radially disposed, and when the plane of cutting passes near the junction of two tiers the section shows large and small cells in alternate radial rows. The small cells are sections of the tips of the fibers forced by growth between their upper and lower neighbors. It is von Höhnel's theory that their appearance in alternate radial rows instead of alternately in the same row is the result of the pressure of the bark upon the cambium while the fibers were being formed.

Tier-like arrangement is most common in tropical woods and has been found fairly characteristic of the families Cæsalpiniaceæ and Zygophyllaceæ. Various writers[2] have

[1] Von Höhnel, Franz Ritter, "Ueber stockwerkartig aufgebaute Holzkörper," *Sitzungsberichte der Mathematische-Naturwissenschaftlichen Classe der kaiserlichen Akademie der Wissenschaften,* Vol. 89, Part 1, Wien, 1884, pp. 30–47. Von Höhnel, Franz Ritter, "Ueber den etagenformigen Aufbau einiger Holzkörper," *Berichte der Deutschen Botanischen Gesellschaft,* Vol. II., Berlin, 1884, pp. 2–5.

[2] Flückinger, J. A., "Pharmacognosie der Pflanzen," 2d ed., pp. 463, 466. Wigand, A., "Anatomische Atlas zur pharmaceutischem Werkende," 1865, tables 26, 27. Whitford, H. N., "The Forests of the Philippines," Bul. 10, Bureau of Forestry, Manila, P. I., 1911, Vol. II., p. 36.

called attention to this feature which is especially striking on red sanders (*Pterocarpus santalinus* L. f.), narra (*P. indicus* Willd.), and Jamaica quassia (*Picrasma excelsa* Planch.). Von Höhnel (*loc. cit.*) observed it in about 80 different woods, all tropical or sub-tropical but one (*Diospyros virginiana* L.), and most of them unidentified. His list of the identified woods includes 35 genera of 12 families, viz., Cæsalpiniaceæ, Papilionaceæ, Mimosaceæ, Zygophyllaceæ, Büttnereaceæ, Malvaceæ, Cedrelaceæ, Bignoniaceæ, Simarubaceæ, Ebenaceæ, Rosaceæ and Sapindaceæ.

Included in v. Höhnel's list are two species which occur in the United States, viz., *Swietenia mahagoni* and *Diospyros virginiana*. In addition to these two the present writer has observed tier-like arrangement in the woods of *Æsculus octandra, Tilia americana, T. pubescens, T. heterophylla* Vent. and *Guaiacum sanctum*.

ÆSCULUS (BUCKEYE)

In the wood of *Æsculus octandra* the rays are fine, uniseriate, uniform, inconspicuous, mostly 10–12 cells high, measuring about 0.25 mm. The average distance between the rays is, verticàlly, 0.15 m.; laterally, 0.06 mm. Their arrangement is in horizontal series, very regular on the radial section but forming somewhat wavy lines on the tangential, though always plainly visible to the unaided eye. The vessel segments are from 0.35 to 0.40 mm. long and are in series, the horizontal planes of their perforations alternating with the rays. The fibers appear not to be in storied arrangement.

The cross-markings on tangential surface are characteristic of *A. octandra* and were not observed in *A. glabra* Willd., *A. californica* Nutt. or *A. hippocastanum L.*, though all three show indistinctly on radial surface a tier-like arrangement of the wood elements. This feature is thus important in separating the wood of *A. octandra* from others of the genus.

TILIA (BASSWOOD)

Tier-like arrangement of the wood elements is characteristic of the woods of *Tilia americana, T. pubescens* and *T. heterophylla*. The ending of the vessel segments, wood fibers and wood parenchyma fibers is quite uniform. The rays are widely variable in size and are irregularly spaced. The small rays are uniseriate and mostly 10–15 cells high; the largest are 3–5 cells wide and 50–100 cells high. The cells are small and much flattened laterally.

The cross-markings of *Tilia* are not conspicuous, but in proper light are usually readily visible to the unaided eye. The average height of the tiers is about 0.40 mm.

SWIETENIA (MAHOGANY)

Tier-like arrangement is often characteristic of the true mahogany (*Swietenia mahagoni*). While it may be absent, it is quite often very conspicuous. When present the tiers vary in height from 0.35 to 0.50 mm. The rays are deep crimson in color, fusiform, and quite irregular in size; 1–5, mostly 2 or 3, cells wide, and 4–20, mostly 10–15, cells high. When the rays are in storied arrangement they coincide with the vessel segments.

Swietenia senegalensis Deso. is said by von Höhnel (*loc. cit.*) to be without cross-striping.

DIOSPYROS (PERSIMMON)

In *Diospyros virginiana* the rays are very numerous, composed of large cells in 1–2 (rarely 3) rows, and from 2–14, usually 10–12, cells high. They are arranged in horizontal series which correspond with the vessel segments, wood fibers and wood-parenchyma fibers. The arrangement is often somewhat irregular and is never conspicuous, though clearly visible to the unaided eye. The height of the tiers is about 0.35 mm. The horizontal seriation of the rays appears to have been first described by Molisch.[3]

Available specimens of the wood of *D. texana* Sch. do not exhibit the cross-markings.

[3] Molisch, H., "Vergleichende Anatomie des Holzes der Ebenaceen und ihrer Verwandten," *Sitzungsberichte der Mathematische-Naturwissenschaftlichen Classe der kaiserlichen Akademie der Wissenschaft*, Vol. 80, Part I., Wien, 1879.

GUAIACUM (LIGNUM-VITÆ)

The wood of *Guaiacum sanctum* exhibits very fine and quite uniform cross-markings, visible with the aid of the lens. The rays are very fine, uniseriate, mostly 5–7 cells high, deeply colored, appearing under lens like fine hachures. The height of the tiers varies from 0.15 to 0.18 mm. The scattered vessels are filled with a dark-colored resin which adds to their prominence. The vessel segments alternate with the rays.

Guaiacum officinale L. is similar to *G. sanctum* in the arrangement of the wood elements. The distance between markings is often as low as 0.11 mm. The rays are about 0.05 mm. apart laterally and 90 μ vertically.

In addition to those mentioned above, the writer has observed many tropical woods (particularly African and Brazilian) with tier-like arrangement of their elements.

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A SCLEROTINIA ON APPLE

PRIOR to 1902 the fungus causing the brown rot of fruit, both drupaceous and pomaceous, was, at least in this country, commonly referred to *Monilia fructigena*. Norton[1] observed the perfect stage of the fungus on peach, and called it *Sclerotinia fructigena* (Persoon) Schroeter. Coincident with Norton's work on the *Sclerotinia*, Aderhold,[2] of Germany, was making a study of some forms of this genus and was able to secure a perfect stage of a *Monilia* on apple. He has published good evidence that the form of *Sclerotinia* he found on apples was *Sclerotinia fructigena* (Persoon) Schroeter, and that the form Norton found on peach was *Sclerotinia cinerea* (Bon.) Schroeter instead of *S. fructigena*, although this name has not since been taken up by American authors.

Aderhold was the first investigator to report the perfect stage of *Monilia* or brown rot fungus on apple, and it has not, so far as I know, been reported since.

I have recently (November, 1911) obtained apothecia of *Sclerotinia* upon mummied apples, which were strikingly different in some respects from those described by Aderhold. These were produced by placing mummied apples in a greenhouse during April, 1911. The mummied fruits were lying upon the surface of the soil and were of course subjected to alternate wetting and drying. During the following summer the greenhouse was neglected and the mummies became very dry, which may to some extent account for the growth of the apothecia later on during the season. The sclerotia remained apparently dormant until a light heat was applied in the building during November. They were first observed by me November 13, 1911. The temperature in the greenhouse at this time was very similar to that of spring conditions, which, I think, was mainly responsible for the growth of the apothecia.

When collecting these decayed fruits only those were selected that were thought to have been grown two seasons previously. Of a dozen or more mummies placed in the greenhouse, all disappeared during the summer but eight; of these eight, five produced forty-one apothecia.

The apothecia arose from the characteristic sclerotia of this genus. The cups varied in size from one to four mm. across. When young they were decidedly campanulate, then flattening to a disk and later becoming cup-shaped again. In color they varied from a cinnamon-brown to gray, when mature.

The mummies were all lying upon the surface of the soil, therefore there was no necessity for a long growth of stipe. Its length ranged on the average from 1 to 2.5 mm. One stipe made a growth of one half centimeter.

In general, the parts of the apothecia are very similar to those growing upon peach, and also to those described by Aderhold as growing upon apple. The most striking dissimilarity is in size, the new form being much smaller.

The asci measure 44 to 64 microns long and

[1] *Trans. Acad. Sci. St. Louis*, Vol. 12, p. 91, 1902.

[2] *Ber. Deutsch. Bot. Land. Ges.*, Vol. 22, p. 267, 1904. Aderhold and Ruhland, *Arbeit. Biol. Abt. Lamd. Forst. Gesandh.*, Vol. 4, p. 29, 1905.