The rate of cambial activity is of especial value in determining the varying significance of the xylem differentiations in slow-growing deciduous or quick-growing evergreen trees.

HERBERT WRIGHT.

PERADENIYA.

THE MORPHOLOGY OF SPORANGIAL INTEGUMENTS¹.

Angiosperms.

Theories on the nature of the integuments of the *ovule* :—

1. *Foliar-appendage* theory : The integuments are the foliar appendages of the nucellus, which is a stem structure. Supporters of this view : Alex. Braun, Aug. St. Hilaire, Schleiden, Payer, Schmitz.

2. *Sui generis* theory : The integuments are special protective outgrowths of the sporangium, this latter being an organ *sui generis*. Evidence for this view is afforded solely by facts of ontogeny : Strasburger, Goebel, Eichler.

3. *Foliolar* theory : chiefly elaborated by last of undermentioned authors. Based entirely on the evidence of the abnormal metamorphoses of the ovule ; these are of a very constant character, subject to control of very definite laws ; the two integuments tend to proliferate into a three-lobed marginal leaflet or segment of the carpel, of which the terminal lobe, bearing the nucellus (when present) on its upper surface, represents the inner, while the two lateral lobes represent the outer integument ; this is the extreme proliferated form. Between this and the normal ovule *every intermediate transitional form has been observed*, the extent of proliferation depending on the stage of development of ovule at which the tendency thereto sets in. Cases where proliferated outer integument appears as a simple lamina bearing normal cup-shaped inner integument containing nucellus on its *lower* surface ; this structure arises morphologically by fusion of the inner margins of the two lateral lobes of the leaflet in the extreme proliferated form across the face of the latter, the terminal lobe at the same time becoming inrolled. The whole structure and mutual relationship of the parts is well shown by means of certain abnormal forms of foliage-leaf in *Syringa*. Hence the ovular integuments are the morphological homo-

¹ Abstract of paper read before Section K of the British Association, Belfast, 1902.

logues of a three-lobed segment of the carpel. In the normal ovule the upper surface of the inner integument is directed inwards to the nucellus, this latter being morphologically an *emergence* from that surface, while the upper surface of the outer integument is directed outwards and away from the inner integument. This applies to all cases: Brongniart, Warming, Cramer, Čelakovský.

Gnetaceae.

Gnetum has normally three envelopes surrounding the nucellus. Theories as to their nature:—

Some regard outer integument as an ovary, others as a perianth, others again as a third integument. View maintained here that it is a perianth, as two integuments occur uniformly throughout Gymnosperms.

Ephedra and *Welwitschia* each possess two integuments. Theory as to nature of outer envelope in former: perianth.

Coniferae.

Views as to nature of the sporangial appurtenances:—

Baillon, Parlatore, Sperk, and others regarded the single envelope as the ovary; almost all other botanists agree as to its integumental nature. Seminiferous scale: Schleiden, Baillon, Strasburger, Masters, regard it as an *axial* structure; Sachs and Eichler as a *ligular placenta*; Delpino and Penzig as the *two lateral lobes of the bract*; R. Brown as a *carpel*; Van Tieghem as *the first and only leaf of an axillary bud*; Braun, Caspary, Von Mohl, Stenzel, Čelakovský, and several others as homologous with *the two first leaves (or their ovular representatives) of an axillary bud*. Čelakovský holds further that throughout Coniferae the ovule has two integuments; in Abietineae, Taxodineae, Cupressineae, Araucarieae, the outer integument is normally proliferated as a seminiferous scale, this being the exact counterpart of certain stages in the abnormal proliferation of the ovule of Angiosperms; in *Podocarpus*, *Cephalotaxus*, *Torreya* and *Ginkgo* it is the outer fleshy coat of the seed; in *Taxus*, *Microcachrys*, *Dacrydium*, it is the fleshy aril.

Cycadaceae.

Most authors regard ovule as possessing a single integument. Čelakovský considers it, along with *Cephalotaxus*, &c., as being *holochlamydeous*, i.e., having the two integuments intimately united, the outer fleshy and the inner woody.

*Filicineae.**Homosporous Leptosporangiates.*

Čelakovský's view here maintained that *soriferous segment of pinnule*, bearing as a rule sporangia on its lower (dorsal) surface, is the homologue of the outer integument of the ovule in Angiosperms, and *indusium* that of the inner integument. Evolutionary series can be traced beginning with—(1) *Thyrsopteris* and *Hymenophyllaceae*, where indusium, enclosing sorus, is *terminal* to leaf-segment = most primitive type. (2) *Dicksonia*, *Cibotium*, *Davallia*, *Lygodium*: the indusium, along with sorus, is displaced on to lower surface by outgrowth of leaf-segment. (3) *Cystopteris*, *Cyathea*, &c.: sorus arises from earliest stage onward on lower surface. (4) *Polypodium*, *Pteris cretica*: indusium completely disappeared; all these conditions have their homologues in stages of the proliferated ovule.

Heterosporous Leptosporangiates.

In Salviniaceae the fruit is equivalent to an ovule with one integument; indusium = inner integument, and leaf-lobe bearing sorus is probably homologous with outer integument. Striking resemblance between monangic sorus of *Azolla* and an ovule. In Marsiliaceae fruit = compound fruit of Salviniaceae. In *Pilularia* it is homologous with the pinnately 4-foliolate leaf of *Marsilia*; in *Marsilia* with a pinnately multifoliolate leaf. Outer wall of sporocarp is homologous with *upper* surface of outer integument of ovule; indusium, enclosing *many sori*, with inner integument of latter.

In most Filicineae sorus is polyangic: in Schizaeaceae and *Azolla* it is monangic, as in most Phanerogams. In the latter polysorous character occurs abnormally in *Hesperis* and normally in *Cupressus*, where outer integument bears on its dorsal surface several inner integuments containing nucelli.

Lycopodiaceae.

Isoëtes: View of Čelakovský held that *velum* is equivalent to indusium of Ferns, and *ligule* to soriferous leaf-segment of latter; hence sporangium along with these two organs = ovule with its two integuments.

Lepidocarpon: 'Integument' is probably equivalent to velum of *Isoëtes*, but better developed, and thus to inner integument of ovule. Ligule is regarded as really situated outside the 'integument'; the latter is merely a special modification of velum, which is here open at its distal end.

In other genera either velum or both this and ligule have either quite aborted or never been developed, which is probably result of efficient protection of sporangia by peltate ends of sporophylls, as in *Lepidodendron* and *Spencerites*.

In Equisetaceae peltate sporophylls afford necessary protection.

W. C. WORSDELL.

KEW.

THE NATURE OF THE VASCULAR SYSTEM OF THE STEM IN CERTAIN DICOTYLEDONOUS ORDERS¹.—

The object of the present thesis is to show, from anatomical data, that no hard-and-fast line exists between the two classes of Dicotyledons and Monocotyledons. The hollow vascular cylinder of the stem of a great number of dicotyledonous orders, if not of all, has been derived from a system of scattered bundles such as is characteristic of the stem of almost all Monocotyledons. The flowering-stem and peduncle, as being those parts of the caulome which have undergone least modification owing to the necessities of adaptation to external conditions, exhibit, as a rule, most clearly the primitive structure which in the vegetative parts has become obscured. The axial organs of the seedling, owing to their limited diameter and the small number of leaf-traces concerned in the building-up of the vascular system, cannot as a rule possibly exhibit the primitive scattered arrangement of the bundles.

As the stem increased in height and became more woody, and the leaves smaller and more numerous, the scattered arrangement of bundles in the stem (chiefly a result of the latter being mainly built up of large leaf-bases from which great numbers of pluriseriate bundles entered the axis) gradually became modified into that of a hollow cylinder, which was necessary both to support the bending-strains from a tall stem, and to facilitate the continuous centrifugal addition of new conducting-tissues by means of a secondary meristem. The stems of plants possessing scattered bundles support bending-strains by means of a sub-peripheral sclerotic band, and, in those cases where a secondary meristem is present, increase their conducting-tissue by the continuous centrifugal formation of new scattered bundles accompanied by interfascicular tissue.

¹ Abstract of paper read before Section K of the British Association, Belfast, 1902.

Worsdell, Wilson Crosfield. 1902. "The morphology of sporangial integuments." *Annals of botany* 16, 596–599.

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