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L. Theugenis. Lept. alis omnibus supra læte flavis, anticis macula media costali apiceque nigris, posticis margine externo nigro. ♂. Exp. alar. 2 unc. vel 50 millim.
Hab. Bolivia.

Anterior wings elongate, rounded at the apex, the first subcostal nervule anastomosing with the costal nervure. Above: bright yellow, the apex from the termination of the first subcostal nervule to that of the third median nervule black; this black patch united to a spot of the same colour occupying the outer margin as far as the termination of the first median nervule. Posterior wings yellow, the outer margin fuscous from the apex to the first median nervule; the fuscous margin broadest at the apex.

Below: anterior wings yellow on the costa and at the apex, the dark markings of the upper surface slightly indicated; the rest of the wing whitish, the inner margin with a large spot of a chalky appearance. Posterior wings yellow, with two pale brown bands, the first extending along the subcostal nervule to its termination, the second below the cell extending from the submedian nervule to the second subcostal nervule, which it just crosses.

Head, thorax and abdomen brown above, yellow below. Antennæ black. Legs, except the coxæ, black, with a pale yellow line on each side.

In the collection of the British Museum.

This species is closely allied to *Lept. Melite*, from which however it may be known by the want of the black vitta on the inner margin and of the yellow spot in the black of the apex, independent of some less striking differences.

XV.—*Reports on the Progress of Physiological Botany.* No. 2.
By ARTHUR HENFREY, F.L.S. &c.

Anomalous Forms of Dicotyledonous Stems.

PROF. TREVIRANUS* has published an exceedingly interesting essay on the anomalous forms under which the wood presents itself in certain dicotyledons, in which he endeavours to arrive at some general conclusions as to the regulating causes. The essay is a kind of critical examination of all the observations hitherto published on the subject, interspersed with the results of new investigations undertaken by the author with a view to explain or confirm the views of other writers.

Our attention is first directed to those remarkable bodies called

* Botanische Zeitung, May 28, 1847.

Embryo-buds, first described by Dutrochet*, and considered by him to be buds, which instead of becoming elongated are developed on all sides, and, producing no leaves, are nourished by the sap of the bark. Prof. Treviranus remarks that this view is difficult to reconcile with the generally received opinion that the formation of wood depends on the presence of leaves, and new investigations upon living specimens are very desirable; it is obvious however that the production and development of secondary layers of wood occurs here, quite separate and distinct from the central primary ligneous body of the tree. [With regard to these remarks it may be observed, that it is only if we admit the notion that the new layers of wood actually grow down from the leaves, like roots, as is affirmed by Gaudichaud, that there is any difficulty in adopting Dutrochet's views. If the leaves only elaborate the juices for the formation of new wood, the elaborated sap conveyed down in the bark and cambium-layer may go to form new layers around the nucleus it finds in the shape of an embryo-bud, just as readily as to increase the great central woody mass of the tree.—*Rep.*]

The author next notices those stems in which, in addition to the central woody mass, from three to ten smaller ligneous masses occur surrounding the central one and increasing in size in proportion to it. Mirbel† first pointed out this structure in *Calycanthus floridus*, and Gaudichaud‡ in the *Sapindaceæ*. The course of the formation of the four secondary woody masses in *Calycanthus* is as follows:—In a young stem there are found four vascular bundles in the bark, distinct from the central wood, and from each other except at the nodes, at every one of which cross bundles uniting these together form a ring round the central body; as the stem grows, new layers of woody substance are deposited on the *inner* faces of these bundles (which are of course carried outward with the bark to make room for the increasing thickness of the central mass of wood). These new layers are considerably thicker than the outer, previously formed; they are also progressively wider, and thus form a somewhat crescent-shaped body (when seen in a transverse section); the horns of the crescent advancing outward gradually approach and meet, so as to include a portion of the bark, which then forms what resembles a kind of pith to it. This false pith of each woody mass is thus of course excentrical, the woody layers which surround it being fewer and thinner on the outer side.

In regard to the origin of this structure, Mirbel compared the four bundles to those lying in the angles of the square stem of

* Nouv. Mém. du Mus. d'Hist. Nat. iv.

† Ann. des Sc. Nat. xiv.

‡ Archiv de Bot. ii.

Labiata ; but the author states that this is incorrect, inasmuch as these latter are the commencement of the central ligneous system, being in fact afterwards united together into a ring by new bundles which are produced between them.

The author says he formerly imagined these secondary wood masses to have the import of branches, but he has now given up this opinion, having found the structure to be normal in several other instances. In trees with opposite leaves, like the ash and horse-chestnut, the woody mass presents the following peculiarities in the youngest internode : the vascular bundles from each petiole, arranged in a semicircle, unite with those of its fellow to form a circular or rather somewhat quadrangular mass ; at the next node below, this opens on opposite sides to receive the bundles of the petioles there situated, and again closes. In *Calycanthus* the fibrous substance of the petiole also forms a semicircle, containing the vascular bundles of all the nerves of the leaf except that of the lowest or outermost nerve on each side, which remains isolated. This isolation is persistent after the two semicircular fibrous bodies have united at the node to form a ring, and thus it happens that the bark of the new-formed stem contains four smaller vascular bodies, outside the regular ring of wood and occupying the four obtuse angles. Tracing the course downward in the stem, we find, at every node, that not only the central ring, but the cortical woody bodies receive accessions, and they have grown independently. In *Calycanthus floridus* therefore (and in *C. præcox* also, although it is not so distinctly exhibited here), the four cortical ligneous bodies originate in the leaf, run down in the angles of the gutter-shaped petiole, distinct from the central mass, and enter the bark at the nodes, where each of them unites with one similar coming down from the leaf above and another coming from the leaf opposite. This observation has already been made, substantially at least, by Gaudichaud, but was doubted, without statement of the reason, by Lindley. Any one may readily satisfy himself of its correctness who will examine this common shrub. [I found the above description of the structure perfectly correct as regards *C. floridus* ; I have not examined *C. præcox*.—Rep.*]

The woody stems of certain climbing *Sapindaceæ* are still more remarkable on account of the number and size of the lateral woody masses ; sometimes as many as ten of these occur, inclosed in a common bark, and these rapidly increase in size to

* The arrangement of the woody bundles of the *Cucurbitaceæ* which have pentagonal stems, described by Dr. Stocks in the 'Ann. of Nat. Hist.' for Aug. 1846, bears some relation to this point. It would be interesting to ascertain whether any of them remain distinct, or if they become blended as in the *Labiata*.—Rep.

such an extent, that they often, collectively, exceed in volume the central ligneous mass of the stem. No other plants but the *Sapindaceæ* are known with certainty to possess this structure, and not even all the genera of this family, nor all the species of particular genera. Gaudichaud does not name the species and only doubtfully the genus in which he found it; A. de Jussieu* names only *Serjania cuspidata*. The author has detected it in *Paullinia pinnata*, *Serjania triternata*, W., and *Serjania Selloviana*, Kl., but not in *Serjania rubifolia*, K., and *Paullinia obliqua*, K.; not in *Cardiospermum*, *Nephelium*, *Kæbreutera*, *Sapindus saponaria* and *capensis*. He had at his disposal a living stem of *Paullinia pinnata*, bearing leaves, the length from ten to twelve feet, and the thickest portion a German inch in diameter. This stem presented three convex sides and as many obtuse angles in each of which lay a woody mass unconnected with the central mass and separated from it by cortical substance; they were of similar form and almost identical structure. In *Serjania triternata* the stem in the young shoots is triangular with a woody mass in each angle, but in the older twigs the angles and their lateral woody masses are seven in number, and the same structure occurs in *S. Selloviana*, Kl., so that it may be concluded with tolerable certainty that the woody bodies which Gaudichaud† indicated generally as belonging to *Sapindaceæ* were either species of *Paullinia* or *Serjania*. The same may be said of a form of wood from an unknown source described and figured by the author in his 'Physiology of Plants'‡. The number of lateral masses may as above shown increase, but it may also decrease by some of them losing their independence. In one of Gaudichaud's§ plates the upper end of one specimen exhibits nine, the lower only five, another seven above and five below; so that some of them have either become united together or to the central body. Jussieu says: the four woody masses of *Serjania cuspidata*, at the first formation of a shoot, are united into a single mass; but they soon separate and become isolated. The author also, in the twigs of *Paullinia pinnata*, where they run out as side shoots from the triangular main stem, perceived that the form was originally cylindrical, and thus only a central woody mass existed, but that in its course one or more lateral bodies disengaged themselves. The manner in which this took place is thus explained: the circle formed by the aggregated bundles presents three obtuse angles, and the bundles which form these angles diverge outward and leave the combination. They then become

* Monogr. Malpigh.—Archiv du Mus. iii. 110, 117.

† Rech. sur l'Organogr. &c. des Veg. t. 13. fig. 1-4. t. 18. figs. 14, 16, 18, 19, 21.

‡ Phys. d. Gew. ii. 174. t. 1. fig. 6. § Loc. cit. t. 18. figs. 16, 19.

placed so as to converge more toward each other, since they take away a portion of pith with them, and the centripetal arrangement is finally perfected. In a directly opposite manner occurs their reunion with the central mass by the loss of the concentric arrangement of their woody bundles, and their reception into a cavity which is produced at a corresponding point in the central mass.

From the nature of the composition, therefore, the lateral bodies have a pith, like the central, also medullary rays and fibrous tubes, but the author has not observed annual rings in either. The existence of this pith in the lateral bodies has been denied*, but on insufficient grounds; the round or oval central cellular mass into which the medullary rays enter, for example in *Paullinia pinnata*, cannot be called anything but pith. A. de Jussieu also describes a pith in the lateral woody masses of several *Sapindaceæ*, especially *Serjania cuspidata*, which pith was inclosed in a medullary sheath containing spiral vessels, and was of a cylindrical or flattened form. Gaudichaud figures the latter form of pith, which is centrally situated in the central woody mass, but more or less excentrical, toward the external surface, in the lateral bodies.

It is important to observe that the central and lateral bodies are all inclosed in a common bark which contains a common layer of liber; since this proves that the lateral woody masses are not liber-bundles of the bark, as Martius† appears to have assumed. But the author observes that, so far as his limited materials allowed him to see, the circle of liber above-mentioned does not increase in diameter proportionately with the woody masses.

An attempt has also been made by Martius to explain the presence of these anomalous lateral masses by considering them as undeveloped branches running under the bark in the manner that the roots do in some *Lycopodia*, as was pointed out by Ad. Brongniart‡, who thereby explained some phænomena observed by him in the fossil genus *Sigillaria*. Lindley§ has observed a similar condition in a *Barbacenia* from Rio Janeiro. Before these phænomena can be applied to an elucidation of the structure of the *Sapindaceæ*, it is necessary to investigate these lateral woody bodies in their earliest conditions. With this view the author examined *Paullinia pinnata*, taking a yet herbaceous twig about eighteen inches long on which three leaf-scars existed on the three angles, while two leaves were still in a vege-

* Schleiden, Grundz. 2nd ed. ii. 162.

† Ueber die Veg. d. unächt. u. ächt. Parasit. Münch. gel. Auz. 1842, N. 44-49. 390.

‡ Archiv du Mus. i.

§ Introd. to Bot. 3rd ed. 316. figs. 191-3.

tating condition at its apex. Each scar presented on its roundish disc the almost perfect circle of vascular bundles of the fallen leaf; above the scar was a dried bud, and below it a strong, blunt ridge ran downward on the stem. On each side of the cicatrix was a little semicircular scar indicating the articulation of the fallen stipules, and from each of these lateral scars an acute ridge originated which became united with a similar one coming down from the leaf next above. On the examination of the living leaves it was perceived that the vascular bundles of the petiole formed the central woody mass, and those of the wing of the petiole and of the stipules, the lateral bodies. These were quite isolated just below the node; but in another twig which was examined, either two or the whole of them were always united to the central mass, and this was particularly the case in a twig which had a roundish instead of the usual triangular form. So that this anomalous structure of the wood of *Sapindaceæ* has its origin at the earliest stage, and is connected with the formation of leaves rather than of branches, and depends upon a peculiar tendency of the vascular bundles to develop independently of each other, round several centres, which tendency however they occasionally lose and subsequently blend with the central mass.

The structure of the wood of the Malpighiaceæ Lianes agrees to a certain extent in appearance with that of the *Sapindaceæ*, and here it is evident that the lateral bodies do not belong to the liber. But according to A. de Jussieu the lateral bodies show no disposition to arrangement of their fibrous tubes and vessels around a pith, as occurs in the *Sapindaceæ*. He has also shown that the wood lying immediately around the central pith is very regularly formed, and has narrower and straighter medullary rays than the layers subsequently produced; while in the *Sapindaceæ* the separation of the lateral from the central masses is evident in the very earliest stages of the formation of the wood.

In the same memoir Jussieu has mentioned several climbing dicotyledons of very different families, where the masses of wood have a tendency to become separated from each other; to these may be added the climbing species of *Begonia*. Those species of *Begonia* with an upright stem have the wood symmetrically formed, but in, for example, *B. hirtella*, the wood on the side of the stem next the wall on which the plant grows is scarcely half so thick as upon the other side which has been exposed to no pressure; on this side the wedges of wood are much expanded and quite unsymmetrical, being separated from each by medullary rays which equal them in breadth.

Lastly may be mentioned some peculiarities in the wood of certain climbing *Bignoniaceæ*, figures of which are given by Lind-
Ann. & Mag. N. Hist. Ser. 2. Vol. i.

ley*, Gaudichaud † and Schleiden ‡. Here the general mass of the wood is interrupted by plates of a different substance which pass in from the circumference to the centre, which substance, if it be wood, is of a distinct kind from the rest ; these plates correspond to each other on the opposite sides of the stem. Gaudichaud says that the *Bignoniaceæ* in Guayaquil have originally four of these plates, next eight, then sixteen, and probably afterwards thirty-two ; but he never saw this in the plateaux of Brazil.

Analogous but less regular divisions of the wood occur to a certain extent in old stems of *Bignonia capreolata*, but here only four plates exist in stems even two inches in diameter. In a stem of a *Bignonia* collected in Columbia by Karsten (marked No. 33) there are eight such divisions, of which four are not so broad as the other four, and they correspond to each other exactly on opposite sides of the stem. Jussieu found four in *B. Unguis Cati* and *B. grandiflora* ; in a Bignoniaceous plant from Peru eight, with the traces of the commencement of a duplication of them, which would thus have made sixteen.

Their intimate structure exhibits chiefly fibrous tubes, agreeing with those of liber, but in *B. capreolata* the author found vessels. The former are arranged in transverse rows with thin layers of cellular tissue interposed ; an organization similar to that of liber. They never reach quite to the pith, the wood immediately surrounding this is therefore undivided, and they are only firmly united to the true wood at those points where they terminate internally. A recently gathered leafy shoot of *B. capreolata* about a line and a half in diameter, exhibited the first trace of these four introversions of the liber. Where each of these originated in the bark there was a fibrous bundle like the others, but much larger. There were four of these chief bundles, and they had their origin in the petiole like the woody bodies of the bark in *Calycanthus* and *Paullinia*. It appears therefore that continual additions are made to the liber on the inside of these bundles as the wood of the stem increases in diameter, and consequently, no formation of true wood occurring at these points, cavities would result, but that the liber bundles grow inward and fill them up.

Comparing these last-mentioned forms of ligneous structure with that of *Calycanthus*, of certain *Malpighiaceæ* and *Sapindaceæ*, the distinction is observed, that in the *Bignoniaceæ* the fibrous substance, separated from the chief mass of the wood, does not develope outside the latter, but in and with it, at the same time

* Introduct. to Botany, fig. 38.

† Recherch. &c. t. 14. fig. 4, t. 18. figs. 4-10.

‡ Grundzüge, &c. 2nd ed. fig. 146-148.

without becoming blended with it. But here however, as in the *Malpighiaceæ*, has been observed a disposition to separation of certain portions of the wood from the central mass*.

We require more investigation to enable us to determine the relations of the structure of *Phytocrene* to that of the *Bignoniaceæ*; especial attention should be paid to the conditions at different periods of the growth. Jussieu opposes the opinion that the plates passing inward from the bark belong to the liber, on account of the different structure of the liber observed in the same stem. But since this difference consists in the fact, that, according to Griffith†, they also contain striped vessels of small size, while in the proper wood these are larger, in shorter joints and of the dotted kind, the author does not think this is sufficient reason to upset the idea that they originate from the liber. In *Nepenthes* the ligneous twining stems, the bark, liber and pith, are full of spiral-fibrous cells‡, a proof that under certain circumstances these may occur in parts of the stem where they are not usually found.

Glancing retrospectively over the anomalous forms of dicotyledonous stems we have enumerated, this much is evident, notwithstanding the imperfection of the observations arising from the want of materials:—the fibrous and vascular bundles descending from the leaves are in general destined to be collected around a common centre and there to become united together, but yet in their ever-progressive vegetation a certain independence is retained by them, so that certain collections of them may separate from the main body and be developed independently. This development will at the same time proceed according to the law of symmetry, *i. e.* they will arrange themselves around a centre, and, in case the stem belongs to a dicotyledon, be placed in a radiating series behind one another. What external cause must arise, to produce such deviations from the usual mode of growth, cannot yet be determined for want of comparative observations, in the localities where these stems are found. Jussieu conjectures § that one of the chief causes of these peculiarities is the remote position of the leaves, the distance between them being greater in the Lianes than in other plants. But the author says, that, if he is not mistaken, twining shrubs of the same families are met with without the anomalous structure; thus it seems that some special impression must be received, which is given to the formative principle by some external cause, such as pressure in a particular direction, as mostly if not always happens in climbing stems. It is well known that *Bignonia radicans*, also

* Jussieu, Mém. Malpigh. 119.

† Wallich, Pl. Asiat. Rar. 216.

‡ Korthals Verhandelingen, t. 20.

§ Cours de Botanique, t. 81.

a Liane, has, when in a condition where it can freely extend itself, the usual symmetrical wood-structure. But Uttewall* observed a stem of this plant flattened into a band-like form, arising from pressure against the angle of a wall, which form it still retained after it had grown up far beyond it, so that the numerous shoots afterwards developed all partook more or less of this character.

[As somewhat relating to the present subject, may be mentioned a curious fact lately pointed out by Prof. A. E. Rossmässler. He states that the Firs are subject to a peculiarity in the growth of their wood which causes them to split obliquely instead of perpendicularly, and that this occurs, for instance in *Pinus sylvestris*, throughout whole estates, in Bavaria, and it is necessary to raise young plants from foreign healthy seed, since the seeds of these twisted firs inherit the peculiarity of the wood.—*Rep.*]

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Rare and Remarkable Animals of Scotland, represented from living Subjects; with practical Observations on their Nature. By Sir JOHN GRAHAM DALYELL, Bart. Volume first, containing fifty-three coloured Plates. London: John Van Voorst, Paternoster Row, 1847. 4to. Pp. 270.

WE could wish that this noble volume was in the hands of every one of our readers. It is, always excepting Ellis's 'Essay on Coralines,' the most valuable contribution to Zoophytology ever made by one individual, and contains more that is true and of interest in the economy of zoophytes than any other work hitherto published.

The name of Sir John Graham Dalyell has been familiar to the naturalists of Scotland for nearly half a century. He first introduced himself to their notice by a translation of some of the physiological writings of Spallanzani, a naturalist of congenerous dispositions with himself; and he subsequently became better known by his valuable contributions to our national Encyclopædias, and by his little book on the *Planariae*, the most interesting by far of any publication on this family of worms. But beyond his native country Sir John was scarcely known until after the meeting of the British Association in Edinburgh in 1834, when the naturalists of England even were taken by surprise on finding one unbruited,—an accomplished scholar and learned antiquary,—who had studied natural history in a more philosophical spirit, and with a less selfish love, than any more blazoned compeer, and who had learned much in the school of nature of what was secret and hidden to others. Henceforth this quietly perse-

* Tijdschr. v. Natuurl. Gesch. en Physiol. iv. 90