313. Carex stenophylla?, *Whlbg.*
311. Cyperus aristatus, *Rottb.*

GRAMINEÆ.

15. Gymnothrix flaccida.
12. Hierochloe laxa, *Royle.*
14. Melica ciliata, *L.*, var.
13. Agropyrum semicostatum, *Nees.*
0. Elymus europæus?, *L.*
312. Rottbœllia, species.
16. Rottbœllia, species.

POLYPODIACEÆ.

0. Polypodium lineare, *Thunb.* Chundra valley above Koksar. M. Heyde, collector.
303. Allosorus crispus, var. Brunonianus.
302. Cystopteris fragilis. This is the common fern of Lahul; 303 is much less so.

Notes on *Myrtaceæ*.

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THE Natural Order of Myrtaceæ is one of the most important in tropical and Australian regions. Scarcely yielding to the Conifers of temperate regions in the gigantic size of some of its trees or in the value of the timber they form, the spices and oils it supplies have long been staple articles of trade. Some of the fruits it produces are highly prized; and many species are cultivated for ornament in the plantations of warmer countries as well as in our own conservatories. But, to the botanist, the distinguishing and classifying their numerous species is a task far from giving satisfaction in proportion to the labour it entails. In some cases the uniformity of structure prevailing through hundreds of species is so great as to have induced monographists to take up the most vague and trifling characters even for generic distinction; in others the same characters have been found here clearly to separate large undoubtedly distinct groups, and there to be so mixed up and confounded together in one and the same natural group as to be no longer available for any more than specific distinction. Some, again, of those which, as far as known, appear to be the most constant are rarely supplied by herbarium specimens; and among the

more apparent ones, those the most useful for distinguishing great groups in one of the three great centres of the order, South America, tropical Asia, and Australia, will not always hold good in the others. The consequence is that no general arrangement can be satisfactory, if founded on the species of one only of those regions; and of this description are all those that have been proposed since the 'Prodromus' of DeCandolle. His distribution was very good, considering the scanty materials he then had at his disposal, but has required very great modifications after the large accessions we have since accumulated. This rearrangement has been more or less worked out for each of the three regions in two opposite directions. An enormous multiplication of genera and species has been proposed by O. Berg for the South-American Myrtaceæ, by Blume for those of tropical Asia, by J. C. Schauer for the Australian ones, and by Brongniart and Gris for the smaller group of New Caledonia; whilst reconsolidation has been more or less effected by Grisebach for tropical America, by Wight and A. Gray for tropical Asia, and by F. Mueller for Australia; and, whether disruption or consolidation have been the guiding principle, the characters made use of in such widely spread groups as *Myrtus*, *Eugenia*, and their allies have often been different, according to whether the American, the Asiatic, or the Australian species have been chiefly had in view. All these difficulties which the systematist has to encounter are not a little enhanced by the tedium of examining ovaries and seeds in an Order where their resinous or woody nature often requires much boiling to soften them, and where especially it is so unsafe to conclude upon the structure of one species from the examination of an apparently closely allied one—where in such vast natural and almost uniform genera as *Eugenia*, *Eucalyptus*, and *Melaleuca*, a very few species, and sometimes a single one, may, without any external indication, have a totally exceptional anther, or ovary, or embryo.

Having myself on former occasions examined a large number of American and Asiatic species, and having now been obliged carefully to go through the whole of the Australian ones, as well as many species of the tropical genera which had not previously come under my eye, I have thought it might be worth prefacing my notes on the limits of individual genera by a few remarks on the stability and instability of the several characters observed, which I shall take in the usual systematic order, commencing with the flower and fruit and then passing to the organs of vegetation.

1. Calyx.

The modifications of the calyx in Myrtaceæ have been made great use of by the multipliers of genera, and more or less passed over by the consolidators. Tested by the degree of constancy in groups otherwise natural, the form of the calyx-tube is but rarely available even as a secondary character, whilst that of its limb or lobes is the only one available for the limitation of some universally admitted genera (e. g. *Verticordia*), or the one mainly relied upon in others (e. g. *Psidium*).

The marked distinction in Myrtaceæ and Rosaceæ between the calyx-tube and its limb, *i. e.* the portion below and above the edge of the staminal disk, is so great that many modern botanists, especially Germans, deny that the former is a portion of the calyx at all. They regard it rather as an expansion of the peduncle, or as a separate organ, which they call *hypanthium*, and limit the calyx to the portion above the disk. This they describe in Myrtaceæ as consisting of distinct sepals, or more rarely as a gamosepalous, lobed, toothed, or truncate limb, or as altogether deficient. Those on the other hand who follow the French doctrine of *soudures* or concretion of organs, give the name of *calyx* to the whole of the external layer of floral covering, from the base of the ovary, whether consolidated with the ovary into a single mass or more or less separable from it, designating as *calyx-tube* the hypanthium of the Germans, whether adnate to the ovary or free; the calyx-lobes or segments of the limb correspond to the German sepals, and the toothed or lobed limb to their toothed or lobed calyx. The settling these differences does not now depend so much upon the observation of facts, which are very generally and accurately known, but upon the most logical, or even the most convenient mode of interpreting those facts; and our conclusions must be drawn, not from the modifications presented to us in Myrtaceæ and Rosaceæ alone, but from what we observe also in other allied orders, and from the general principles forming the theory of concretion and distinction of organs; and I trust I may be excused in recalling here some of the axioms, however simple and generally admitted, upon which that theory is founded, as it appears to me that we are often too ready to lose sight of them in the description of special points.

1. Throughout biology, the organs of a living being are not parts separately formed or superadded to each other, as when we build a house or construct a machine; but every organ, as every

individual, grows out of or proceeds from a preexisting one, of which at first it forms a part. And as, in the case of animals as well as plants, it is not always easy to determine the precise moment when the offspring becomes a separate individual, so, before separation, it is as difficult to fix the precise point marking the commencement of each separate organ.

2. In vegetable homology, the perfect phænogamous plant consists of an *axis* and of *appendages*, often called *leaves*, in a theoretical sense—but which it is more convenient to term *leaf organs*, to distinguish this general meaning from that special modification to which more usually the name of *leaf* is restricted. These leaf organs, under all the variations which distinguish the bud-scale, the leaf, the bract, the sepal, the petal, the stamen, and the carpel, yet agree in their general characters as to origin or insertion, development and ultimate separation from the axis. And in all leaf organs we include in the organ the stalk supporting the lamina—the petiole of the leaf, the filament of the stamen, &c.

In considering, therefore, whether the outer cup, which encloses or is adnate to the ovary in Myrtaceæ, should be described as part of the peduncle (*i. e.* of the axis), or as part of the calyx, or as an independent organ—in determining whether the calyx commences at its base or at its apex, we should compare it not only with the corresponding organ in allied Natural Orders, but also with the corresponding portion of other leaf organs.

In the great majority of cases we have no hesitation in fixing the point where the leaf organ commences. Ultimate separation by disarticulation or decay takes place at the point where it diverges from the stem, peduncle, or receptacle, so that in falling off it leaves only a scar or slight protuberance or concavity. But in all leaf organs, whether vegetable or floral, there are exceptions which have not always been uniformly dealt with.

In the leaf the lower portion of the petiole persists as a spine in *Sarcocaulon*, or hook in some species of *Combretum* and *Smilax*; or the whole rhachis in many *Astragali* and other pinnate-leaved plants of dry hot countries forms a persistent spine; or, in other leaf organs, a portion of the base of the corolla-tube in *Nuxia*, *Dampiera*, and others, or of the filaments of the stamens in *Stylobasium*, *Lecostemon*, &c., or of the carpels in circumsciss capsules, remains also persistent after disarticulation of the remainder. In all these cases we uniformly describe these persistent portions as belonging to the leaf organ, not to the axis; the line of demarcation is at the point of divergence, not at the point of disarticulation.

So it is also when several leaf organs of the same whorl are united by a base persistent after the fall of the remainder, as in the case of the stipular sheath in *Spermacoce*, *Hedyotis*, and some other Rubiaceæ, the persistent united portion of many monadelphous stamens, the hardened persistent base of the filaments in *Melaleuca angustifolia* and many other Myrtaceæ, the persistent base of the corolla in *Nuxia*, the persistent base of the circumsciss capsules of *Sesuvium* and its allies, many Primulaceæ, &c., all of which are universally admitted to be portions of the leaf organs, not of the axis.

It is objected, however, that the case of the so-called calyx-tube of Myrtaceæ and Rosaceæ is very different, inasmuch as more or less of the inner whorls of organs are inserted upon it, and that, as it bears these organs, it must be a hollow prolongation of the axis, not part of a leaf organ. This appears to me to be purely a reversion to the old way of viewing structure before the introduction of the theory of consolidation of organs, which, if retained in the case of the calyx, ought surely to be equally taken into consideration in that of the corolla and other leaf organs.

Leaves are not usually so closely superposed as floral organs, and no instance of consolidation of those of two superposed whorls occurs to me; but they are occasionally concrete at the base with the axillary peduncle. Thus in several Chailletiaceæ, where the flowers were formerly considered to be inserted on the petiole, it is now recognized that the base of the peduncle and the base of the petiole are concrete, and both are supposed to commence from the point of divergence from the stem. So the bracts of Marcgravieæ, of *Tilia*, &c., apparently inserted on the pedicels, are admitted to be subtending bracts with their petioles concrete with the pedicels.

Taking next the leaf organs above or within the calyx, we have much more frequent instances of the concretion of two superposed whorls, closely analogous to that of the calyx, corolla, and andrœcium in Myrtaceæ. Thus in almost all the Monopetalæ (or gamopetalous flowers) the corolla and andrœcium are so much connected at the base that for convenience' sake we describe the stamens as inserted in the tube of the corolla; but at the same time we all admit that both stamens and petals are really hypogynous but concrete at the base, that both commence from the point of divergence from the receptacle; and no one, to my knowledge, has ever proposed that the corolla-tube up to the divergence of the stamens should be considered a part of the receptacle or axis. So also in cases of concretion of the andrœcium and gy-

næcium, as in *Aristolochia*, *Saururus*, *Chloranthus*, &c., the stamens, although described for convenience as inserted on the ovarium, are admitted to be really adnate to them.

It has been supposed that the union of the inner organs with the calyx-tube in Myrtaceæ and their allies, if it exists theoretically, is too complete for their hypothetical distinctness to be more than imaginary, whilst in gamopetolous corollas the filaments can be traced to the base. But that is far from being always the case. In numberless Corollifloræ the bundles of vessels descending from the filaments are absolutely undistinguishable from the veins of the petals; and the cases are comparatively few where the prominent ribs lining the corolla evidently connect the filament with the receptacle. There are, on the other hand, calyciflorous plants, among Lythrarieæ, Rhamneæ, Samydaceæ (Homalineæ), &c., in which the union of the stamens at least, or even of the petals also, with the calyx becomes gradually less complete and is traceable to the base.

Again, it may be said that in all cases of concretion of the inner whorls of floral organs it is only two such whorls that are united —the corolla with the andrœcium, or the andrœcium with the gynæcium; whereas in many Myrtaceæ we are obliged to suppose the concretion of all the floral whorls into one fleshy mass, showing no more trace of a compound nature than the peduncle below it till the organs separate at the summit, and that this structure is much more rationally explained by supposing it to be really what it appears to be, a hollow receptacle or enclosed summit of the peduncle bearing on its margin or inner surface the various organs. But this argument would seem in the first place to carry us to conclusions not only beyond what the advocates of the theory have come to, but in opposition to some which are universally admitted in the homology of Phanerogams, and in the next place to be quite untenable when applied to closely allied plants in the same or in allied Orders.

First, then, if we deny that this cup is a concretion of the base of the floral organs, we cannot fairly make an exception as to the carpels, of which there is no more evidence than there is of the base of the stamens or petals; and we must suppose that the ovule-bearing placentas proceed from a central axis without the intervention of any carpellary leaves, which, like the stamens, petals, and sepals, are inserted at the orifice of the cup. Even this theory has, indeed, been broached by Schleiden, Schychowsky, and some others; but I believe it to be now generally abandoned by most even of those who maintain the peduncular nature of the Myrtaceous and Rosaceous cup.

Secondly, it would, I think, be no difficult matter to trace the gradual disconnexion of the various whorls through nearly allied plants of these and adjoining orders. In many Myrtaceæ where the union at first appears the most perfect, a vertical section will show three more or less distinct layers—the ovary inside, surrounded by the staminal disk, to which I shall presently revert, and the calyx-tube outside. In a few capsular Myrtaceæ, and in many Melastomaceæ, the connexion of the ovary is imperfect, or only along the midribs of the carpellary leaves. In many capsular Myrtaceæ the ovary, especially when the flowering is past, detaches itself in drying. In some dried specimens of *Eucalypti*, I have found the three layers (calyx-tube, staminal disk, and ovary) quite detached from each other by desiccation. In a few species of *Bæckea*, *Tristania*, *Xanthostemum*, &c., as in a large number of Melastomaceæ, the ovary is quite free although closely enclosed in the cup, and in all cases the insertion of the gynæcium is within the cup at its base. Even in those few apocarpous genera (such as *Rosa*, several species of *Bauhinia*, and some other Cæsalpinieæ) where the carpels appear to be inserted on the sides of the cup, their stalks proceed from its base, and are evidently adnate only to the sides, where they form so many prominent ribs.

It is in Lythrarieæ especially that we can observe the gradual liberation of the stamens from the cup. Almost throughout the Order they are inserted at various heights below the petals, sometimes quite at its base, often below the middle; and the filaments below the apparent insertion are either blended with the substance of the cup or are more or less distinct as veins or prominent ribs. The petals in the same Order almost always appear inserted on the margin of the cup between the calyx-lobes; the cup or calyx-tube then becomes strictly analogous to the corolla-tube of those gamopetalous flowers in which the stamens alternate with the corolla-lobes at the orifice of the tube.

In Goodenovieæ we can equally well trace the gradual liberation of the corolla-tube from the cup or calyx-tube on the one hand and from the ovary and androecium on the other. In *Scævola* and *Dampiera* they are all closely adnate to the ovary in one mass, and immediately above the ovary all are free from each other; in some species, however, as in a few Myrtaceæ, the ovary, especially when the flowering is past, detaches itself in drying. In *Goodenia* the summit of the ovary is more or less free, according to the species, the base of the corolla-tube is adnate to the lower portion of the ovary—the remainder of the corolla on falling off with the

stamens leaving a circular star below the top, and sometimes as low as the middle of the capsule. In this genus the calyx-tube is always wholly adnate, but it is sometimes very much shorter than the adnate part of the corolla; in those cases the calyx-lobes are usually adnate also, but not so high up as the corolla-tube. In *Velleia* the whole calyx, whether campanulate and lobed (as in *V. trinervis*), or consisting of distinct sepals, is wholly free, whilst the corolla-tube is adnate nearly or quite to the summit of the ovary. In *Brunonia* the calyx-tube, corolla-tube, and stamens are all entirely free from each other, but so contracted over the ovary as completely to enclose and give it as much an inferior aspect as in *Scævola* and *Dampiera*.

The argument derived from the leaf-like nature of the deciduous calyx-lobes in *Rosa* as compared with that of the cup or calyx-tube, and the usual disarticulation of the lobes from the persistent cup in the allied orders, appears to me to be a very weak one. Similar foliaceous calyx-lobes are not uncommon in gamopetalous Orders (e. g. *Pedicularis*). Disarticulation of the calyx-lobes, though frequent, is anything but universal in Myrtaceæ and Rosaceæ; and in some genera, such as *Prunus* in Rosaceæ, and some species of *Calythrix* in Myrtaceæ, the disarticulation takes place below the insertion (or divergence) of the petals and stamens, in the middle or near the base of the cup or so-called hypanthium.

It has been said that the organogenesis of the flower in Rosaceæ will show that the cup is an after-production of the peduncle after the sepals have been formed. For, it is stated, in the very young bud the sepals form five distinct protuberances round the margin of the concave summit of the peduncle, the carpels occupying the centre of the cavity; the petals and stamens are then gradually produced between the two; and in after-growth a tissue, gradually formed from the receptacle, raises the sepals to a distance from the axis, constitutes the staminal disk, and, in *Pyrus*, envelops the carpels themselves. This is, however, strictly analogous to the formation of the stalks or supports of other leaf-organs, whether single or combined in whorls. The compound leaf of Leguminosæ and other Orders (always excepting Meliaceæ) has every future leaflet defined at a very early stage, forming a cluster variously folded and almost sessile on the stem, but which in the course of growth is gradually raised to a distance from it by the gradual production of the common petiole (proceeding quite as much from the stem as the calyx-tube does from the receptacle);

and yet this petiole is always considered part of the leaf. So, again, in the staminal tube of monadelphous Leguminosæ, at an early stage the stamens are usually all quite free and distinct in a circle round the pistil, and they afterwards become monadelphous, not by the union of any portion once free, but by the growth of a ring or tube under them, raising them above the receptacle; yet I do not believe that any one would propose to describe the staminal tube of monadelphous Leguminosæ as part of the receptacle and not of the stamens. It is from inattention to this mode of formation that some monadelphous Leguminosæ examined in young bud have not been recognized, but published as new genera with free stamens, such, for instance, as *Marquartia*, Vog., and *Bartlingia*, Brongn.

There only remains to consider whether, as a matter of convenience, it may not be better to adopt the name of hypanthium for the united base of the calyx and corolla (or support of the sepals and petals), as we give that of disk to what may be considered an analogous support to the petals and stamens in Discifloræ and Calycifloræ. Considerable confusion of ideas results from calling by different names in different Orders organs which to all appearance are the same, unless it be clearly shown that they are not homologous; and if the various modifications of the calyx in a series commencing with Scrophularineæ, and passing through Lythrarieæ, Melastomaceæ, Myrtaceæ, and Rosaceæ be compared, it will be very difficult to mark the point where the calyx-tube ceases and the hypanthium commences. The name calyx-tube is correct also if the theory of concretion be adopted, whilst that of hypanthium is not strictly so even on the theory of its being an expansion of the peduncle; it means "what is under the flower," whilst the gynæcium always, and in many Lythrarieæ the androecium also, are within it at the base. It will, moreover, be observed that the characters supplied by this calyx-tube are those of external form and indumentum, in which their analogy with similar parts of other Orders is more essential than their theoretical homology.

Before quitting the subject of the terminology of the parts of the flower, I would add a few words on the *disk*, which may be supposed in some points to be analogous to the proposed hypanthium, but of which the theoretical homology is far more doubtful; and the modifications of its form and position supply characters so important that it is very useful to have a name for it quite independent of all hypothesis. Theoretically it may be considered either an expansion of the summit of the peduncle, *i. e.* of the

receptacle or *torus*, or the concrete base of the corolla and androecium; its appearance is more frequently that of the former than of the latter, but its consistence is generally different from both. It does not exist in all plants, and, as far as we know, has no definite function to perform in the floral economy. It can scarcely therefore be called a distinct organ; and we describe it rather as a part of the flower generally, leaving it an open question as to whether it belongs to the axis or to the appendages. When it exists it extends from the calyx to the gynæcium, is often more or less adnate to the one or to the other, or to both, sometimes lining the calyx-tube by a thin layer more or less thickened at the margin, and there bearing the petals and stamens, sometimes closely adnate to and covering the ovary with a thin layer thickened at the top, round the style, into the so-called epigynous disk of Rubiaceæ and allied Orders, and then blended often with the thickened summit of the ovary or base of the style. Sometimes it expands into glands or filament-like appendages, or into an annular cup between the stamens and the style, or more rarely between the petals and stamens, still more rarely outside the petals. These appendages are sometimes definite in number, and even symmetrical with other parts of the flower, but they do not, as far as I am aware, assume the appearance of a real whorl of floral leaves; and all descriptions of the disk, whether it be called staminal, hypogynous, perigynous, or epigynous, must be considered to be descriptions of apparent forms, independent of all theories.

It must be observed also that, notwithstanding the adoption of the theory of concretion of organs, it is much the practice, for convenience' sake, to describe one organ as inserted upon the other,—to which there is perhaps no objection if it be perfectly understood that the description is of apparent, not theoretical insertion. And it is usual to describe the least prominent organ of the two as inserted on the most prominent, or, in the case of floral whorls, those of the least concrete whorl as inserted on the more concrete: thus in Chailletiaceæ, the inflorescence is usually described as inserted on the petiole; in *Tilia*, on the contrary, the bract is said to be inserted on or attached to the pedicel. In most Myrtaceæ the calyx-tube or its lower portion is described as adnate to the ovary, the disk, on the contrary, as adnate to or lining the upper part of the calyx-tube. In Calycantheæ again, and in some Nymphæaceæ, &c., the sepals are adnate to or inserted on what may be called either an enlarged receptacle or the petaline and staminal disk, whilst in Lythrarieæ and others the petals and stamens are adnate to, or in-

serted on, the calyx-tube. So in most Monopetalæ the stamens are said to be inserted on the corolla-tube, whilst in Malvaceæ it is the petals that are adnate to, or inserted on, the staminal tube. The concretion in all these cases is theoretically the same, the diversity of expression being regulated by the difference in proportion of the connate organs.

There is another point in the terminology of the parts of the calyx in Myrtaceæ which requires some fixation; that is, as to what is tube and what is limb—often a very vague distinction, variously interpreted by different botanists. It is usually determined by outward form. Where a calyx or corolla is salver-shaped (hypocrateriform), or simply funnel-shaped (infundibuliform), there is no difficulty, the limb and tube are well defined; in the campanulate corolla or calyx the undivided part is called tube, and the limb restricted to the lobe: but the difficulty lies in those calyxes and corollas approaching to the funnel-shape, which have a narrow tube at the base, then a dilated portion which is still further expanded at the top; here the intermediate portion is by some described as part of the tube, by others as part of the limb, and by others, again, as a separate part called *fauces* or *throat*—a difference of view which renders descriptions of the same corolla by some French and German botanists apparently irreconcilable. In many flowers the expansion from the tubular base through the fauces to the horizontal lobes is so gradual that we can only draw a line at the point of division. In the calyx of Myrtaceæ, however, it has been found better to neglect outward form in this respect, and to take as the line of demarcation between the tube and the limb that of the margin of the adnate staminal disk, which I have above alluded to as constantly distinct,—calling all limb that is above that line, whether entire, lobed, or divided to the base.

The degree of development of the calyx-tube above the ovary (whether the stamen-bearing margin of the disk is close to the ovary, or forms a ring more or less perceptibly or prominently raised above it) has been made great use of for the distinction of genera by O. Berg. It has appeared to me, however, not only to be in most cases purely artificial (that is, unaccompanied by any other character or difference of habit), but frequently inappreciable. Take, for instance, Berg's genus *Aulomyrcia* as distinguished from *Myrcia*, or Blume's *Microjambosa* as separated from the genus or section *Jambosa*: by this character alone not only does each of these segregrated genera include groups of species more nearly allied to corresponding groups in the parent genus than they are to each

other, but there are numerous species where it is difficult to say whether the calyx-tube is or is not to be characterized as produced above the ovary. In capsular Myrtaceæ there are many genera where this development of the tube above the ovary is constant, or nearly so; but I have never found it a safe character to rely upon in species not showing other more essential ones.

The degree of development of the entire portion of the calyx-limb, when the lobes do not reach the disk, is seldom of much importance, although useful in aiding in the discrimination of *Psidium* and other genera of Eumyrteæ, so very deficient in positive characters. It always, however, requires careful attention; for where this part is much developed in the young bud, it is apt to split before expanding, so as to give an erroneous idea of the æstivation of the calyx-lobes. In all Myrtaceæ, except a few genera of the anomalous tribe Lecythideæ, and the still more anomalous genus *Fœtidia*, the æstivation of the real calyx-lobes is, as far as I have observed, always imbricate, or at least not valvate; and, with the above exceptions, it forms an important element in the separation of Myrtaceæ from Lythrarieæ. In *Psidium* and its allies, as in some species of *Bauhinia* and allied Leguminosæ, the real imbricate lobes of the calyx are often so small as to elude observation, or are quite abortive, and the entire part of the limb bursts more or less regularly, so as to have caused the æstivation to be erroneously described as valvate. In other genera the lobes are also occasionally so small, and separated in the full-grown bud by so wide a sinus, that it requires the examination of a very young bud to detect their overlapping. In some, however, the valvate character has been attributed to them, even in the works of distinguished botanists, from mere inadvertence.

The form of the calyx-lobes, which we should *à priori* place low in the scale of importance among generic characters, takes nevertheless a much higher degree in some Myrtaceæ. This is especially the case in the tribe Chamælaucieæ, where it is the most prominent character of two of the most natural and largest genera, *Verticordia* and *Calythrix*, prevailing over the usually more essential ones derived from the anthers.

There are a few Chamælaucieæ (two species of *Darwinia*, *Micromyrtus elobata*, &c.) where the calyx-limb is so minute or even entirely undeveloped, and the petals so apparently continuous with the calyx-tube, that the perianth has been described as simple (one of the causes of the non-recognition of the old genus *Darwinia*). A careful search will, however, generally disclose either micro-

scopic teeth alternating with the petals, or a slightly prominent annular ring. In some species of *Eugenia* (sect. *Syzygium*) and a few other Myrteæ, where the calyx-limb is reduced to a truncate line, the difference of consistence readily separates the corolla from the calyx-tube. This character, however, never appears to be of more than specific value.

The consolidation of the calyx-lobes into a calyptra or operculum, circumsciss at the base, and falling off in a mass, as in *Calyptranthus* and *Acicalyptus*, proves to be a better generic character than a similar consolidation of the petals, which in *Eugenia* is but a vague sectional distinction, and often not constant in species. The peculiarities of the operculum of *Eucalyptus*, whether calycine or corolline, will be better reserved for the special observations on that genus.

A duplication of the number of calyx-lobes occurs in some species of *Verticordia*, in *Pileanthus*, and in *Osbornia*. In the former case, the accessory lobes, different from the normal ones, are evidently a prolongation of the joint nerve produced by the union of the two lateral nerves of two adjoining sepals, as in many Lythrarieæ, Labiatæ, &c., and are in this instance of no generic value. In the other two genera the 10 or 8 lobes are all precisely alike in shape, size, and position, and yet the alternate ones ought perhaps to be regarded as accessory. In *Osbornia*, the petals being deficient, we might have supposed that one half of the apparent calyx-lobes were in fact petals; but there is nothing in æstivation, position, or appearance to justify such an hypothesis; and in *Pileanthus* the normal number of petals and stamens are present notwithstanding the duplication of the calyx-lobes.

2. Corolla.

The petals supply very few good generic characters. They are sometimes wanting; but this is usually in exceptional species or in monotypic genera. They are always imbricate in æstivation, and often very much so, the external one completely enclosing the others in the bud. Their form is often much varied, especially in *Verticordia*; but the differences are not even sectional. In general in the Order they are broad, contracted at the base, or very shortly unguiculate, without the long claws and crumpled laminæ of most Lythrarieæ. In a few species of *Darwinia* and some other Chamælaucieæ, where the calyx-lobes are much reduced or obsolete, the petals are attached by a broad base, and in the bud appear to be continuous with the calyx-tube; and this charac-

ter becomes a constant generic one in *Angophora* and *Eucalyptus*. Sometimes they are so coherent in the bud as to fall off at the time of flowering in a single mass instead of expanding. A large group of Old-World *Eugenias* has often on this account been generically distinguished; but so many species have shown a gradual passage from a tardy or uncertain separation to a permanent cohesion, that most botanists have now given up *Syzygium* as a genus. In *Eucalyptus* the consolidation is so absolute that it is only by analogy with *Angophora* that we infer the origin of the operculum.

3. Andrœcium.

The stamens, as in some other large Orders, supply, in some cases, many of the best generic characters, whilst in others the same modifications can only be taken as specific or, at most, sectional.

Their insertion is always close to that of the petals, the disk, whether thin and lining the calyx-tube or more or less thickened, being always developed between the stamens and gynæcium, not between the stamens and petals as in most Lythrarieæ, where, in other words, the stamens are usually inserted on the calyx-tube much below the petals. Where the stamens in Myrtaceæ are in one or two rows, they are on the margin of the disk; where there are many rows, they cover the surface of the disk in a ring spreading from the margin more or less towards the centre, but always leaving a clear space in the centre round the style, this clear space being thin or thick, concave or convex, or projecting in a ring at some distance from or close round the style. Sometimes the margin of the staminal disk, or united portion of the andrœcium, projects beyond the insertion of the petals in the form of a single ring or short tube, or of a one-sided appendage, or of five regular appendages alternating with or opposite to the petals, bearing the filaments on their margin or inner face—always quitting the calyx-tube at the same point as the petals, which remain free from the projection, or, when it is annular, are more or less adnate to it at the base. Without always supplying positive generic characters, these modifications are most of them very useful. The annular union of the base of the stamens is general in most Eucha-mælaucieæ, it is one of the chief characters of *Hypocalymma*, and occurs here and there in other Leptospermeæ, as well as in some Barringtonieæ, without being of much more than specific importance. The projection of the margin of the staminal disk into a

single unilateral stamen-bearing appendage, as in several Lecythideæ, or into as many regular stamen-bearing appendages (or claws of staminal bundles) as there are petals or calyx-lobes, as in *Melaleuca* and other polyadelphous Leptospermeæ, is in most cases taken as an absolute generic character, being constant in a very large number of species otherwise allied. In *Astartea* these staminal bundles are opposite to the calyx-lobes, or alternate with the petals; in *Melaleuca* and its allies they are, on the contrary, opposite to the petals—a difference more important than the actual prominence or non-prominence of the disk (polyadelphy or freedom of the stamens); for the former distinction, or a tendency towards it, when it exists, generally separates the natural subtribe Bæckeeæ from the other Leptospermeæ, whilst the passage from the union of the stamens in phalanges or bundles to their more or less conspicuous juxtaposition in clusters, and thence to the regular uninterrupted ring, is sometimes gradual. This polyadelphy or freedom separates *Astartea* very artificially from *Bæckea*; it is quite constant in *Lamarckea*, *Conothamnus*, *Beaufortia*, *Regelia*, and *Calothamnus*, nearly constant in separating the large genus *Melaleuca* from *Callistemon*, but becomes vague or specific only in *Phymatocarpus*, *Eremæa*, and *Eucalyptus* (*Eudesmia*), and scarcely constant in *Tristania*.

In point of numbers of stamens, the general character of Myrtaceæ as compared with Melastomaceæ is their indefiniteness; and this is perhaps quite constant in Myrteæ and Lecythideæ, even where, as in *Myrrhinium*, their total number is usually below that of twice the petals; it is also constant in most genera of Leptospermeæ, and in *Calythrix*, *Lhotzkya*, and *Homalocarpus* among Chamælaucieæ. In the remaining Chamælaucieæ the number is as constantly definite, twice or four times that of the petals; whilst in the very natural genera *Scholtzia* and *Bæckea* the character entirely breaks down: constant in species, it barely serves to make artificial sections.

The inflection of the stamens in the bud is a very general character, not only in Myrtaceæ, but in Melastomaceæ and other allied Orders, but it is not quite constant. O. Berg found them erect from the first in a Brazilian shrub allied to *Psidium*, which he not only established as a genus under the name of *Feijoa*, but raised to the rank of a distinct tribe of Myrtaceæ, believing it to be also exceptional in the presence of albumen. We have retained it as a genus, as there appear to be other minor points of distinction; but the stamens erect in the bud appear occasionally

also in other genera, as, for instance, in a few species of *Eucalyptus* allied to *E. cornutus*.

In those Chamælaucieæ which have uniseriate stamens, normally four times as many as the petals, the perfection of the whole, the reduction of the alternate ones to staminodia, or the complete disappearance of the latter, are fair generic distinctions. In *Thryptomene* and *Micromyrtus* there are no staminodia; in both, the stamens are either equal to or twice the number of the petals; but when reduced to the simple number they are in the one case opposite to, in the other alternate with the petals—a remarkable difference in genera otherwise so closely allied. In the other tribes of Myrtaceæ, the presence of staminodia or of abnormal stamens is rare, and when it occurs, although a useful auxiliary, is scarcely an absolute generic character. The very remarkable stamens and staminodia of *Napoleona* and *Asteranthos* will be referred to under those genera.

The anthers in Myrtaceæ are, generally speaking, versatile, with two parallel cells opening longitudinally, whilst in Melastomaceæ they generally open only in terminal pores, one to each cell, or the two continued in a single terminal tube. But in both Orders there are exceptions. In Myrtaceæ these exceptions are sometimes generic, sometimes sectional or specific only. The peculiar anthers of *Beaufortia*, *Regelia*, *Phymatocarpus*, *Calothamnus*, *Eremæa*, and *Gustavia* define genera separated also by other characters. So also the biporose and birimose anthers afford a good distinction between *Darwinia* and *Chamælaucium*, whilst the same character becomes sectional only in *Verticordia*; and in the great genera *Bæckea* and *Eucalyptus*, the passage from the one to the other is, in many cases, so gradual as to be scarcely available as a positive specific character. The vast genus *Eugenia*, amidst hundreds of species with the greatest uniformity in the structure of the anthers, presents, as far as known, only one single exception: the anthers of *E. Smithii* are divaricate instead of parallel—one of the very few characters to distinguish this species from the closely allied *E. Ventenatii*. The appendages to the anthers of some species have sometimes, as in *Chrysorrhoe*, Lindl., been proposed as a generic character, which has entirely broken down on further investigation.

4. Gynæcium.

The perfectly inferior ovary (that is, its being adnate to the calyx-tube up to the margin of its flat, concave, or convex summit)

is the general character of the Order; but there are a few exceptions, and, as in some other Orders, such as Rubiaceæ, Campanulaceæ, &c., where this character is important from its all but universality, these few exceptions are specific only, not generic. It is as impossible to found definite groups on the greater or less degree of adherence of the ovary in *Bæckea*, *Hypocalymma*, *Leptospermum*, *Melaleuca*, *Beaufortia*, *Calothamnus*, *Tristania*, *Cloezia*, *Metrosideros*, *Xanthostemon*, *Couroupita* or *Lecythis*, as it is in *Hedyotis* or *Lobelia*.

The number of parts or carpels of the gynæcium was in former days considered of much importance in the distinction of genera, and, although now found to be often very variable, in Myrtaceæ is still occasionally available for that purpose. There are, for instance, large genera (such as *Myrtus*, *Myrcia*, and *Eugenia*) where the number is, with very few exceptions, two or three, and others (such as *Campomanesia*, *Psidium*, *Calycolpus*, *Decaspermum*, &c.) where that number is very rarely below four or five; and the whole tribe of Chamælaucieæ is still more constantly circumscribed by the monocarpellary gynæcium: but even this is not quite definite; there is a passage from *Thryptomene* to *Scholtzia*, which makes it sometimes uncertain whether we have one 2-ovulate, or two 1-ovulate carpels.

The modifications of the style are few, relating chiefly to its length and the degree of dilatation of the stigma, and are specific only, or scarcely even so much.

There is very frequently a thickening of the disk within its stamen-bearing margin round the base of the style. In some Barringtonieæ it forms a prominent ring, or short cup, about halfway between the staminal margin and the central style; more frequently it is thick at the staminal margin, and gradually attenuate to the centre, making a concave summit to the ovary; or, in a great many Leptospermeæ, it is thick all over, and pulvinate, leaving only a very narrow tubular cavity round the style. In several of those species of *Calythrix* and *Bæckea* in which the calyx-tube, lined by the thin disk, is produced far above the ovary, and the staminal margin is thickened round the style, this thickened margin has been mistaken for the summit of the ovary, which has been described as not completely closed, but pierced through for the passage of the free style. This, for instance, was one the chief characters on which the genus *Babingtonia* was founded. A careful examination, however, of species has persuaded me that these modifications of the epigynous disk in Myrtaceæ, as in Umbel-

liferæ, Cornaceæ, and Rubiaceæ, although constant in species, is seldom, if ever, available for generic distinction.

The number of ovules in each cell of the ovary is useful to attend to only where there are one, two, or few, as it is otherwise variable, even in species; but placentation and the mode of insertion of the ovules is, within certain limits, and especially in the capsular tribes, one of the most constant generic characters in the Order, and only recently much attended to. It exercises some patience in its investigation, but it well repays the trouble, and has the advantage of being supplied by most herbarium specimens. As a general rule the character of the order is to have anatropous, or more or less amphitropous ovules, attached in two or more rows to an axile placenta; but the minor modifications are innumerable. The placenta itself is attached to the middle of the axis, or adnate to nearly its whole length, or arises from near or from quite the base, or descends from the upper angle of the cell. In many (if not in all) Chamælaucieæ, the 1-celled ovary being probably monocarpellary, the placenta is more or less approximate or adnate to one side of the cavity.

Osbornia and *Rhodamnia* become 1-celled from the non-development of the placenta-bearing dissepiments; and the placentas are almost basal in *Osbornia*, parietal in *Rhodamnia*. The ovules, more or less curved, or nearly straight, and more or less amphitropous in the great majority of Myrteæ, as in many genera of Leptospermeæ and Lecythideæ, become nearly anatropous and descending (unless when closely packed) in *Leptospermum*, *Kunzea*, *Tristania*, *Backhousia*, and *Grias*, ascending (unless when closely packed) in *Melaleuca*, *Agonis*, *Phymatocarpus*, *Calothamnus*, *Eremæa*, *Syncarpus*, *Lysicarpus*, *Cloezia*, *Tepualia*, and *Couratari*. The laterally attached ovules are usually superposed in two or rarely four vertical rows, which are parallel when the placenta is narrow; but in *Bœckea* and some allied genera the placenta is sometimes dilated, assumes more or less of a peltate form, and the two rows of ovules form a regular ring round its margin, and in *Xanthostemon* (*Fremya*, Brongn. and Gris) the placenta elongates with the ring of ovules below its apex. Where the ovules are anatropous or nearly so, as well as in a few genera where they are very numerous, although more or less amphitropous, they often occupy the whole surface of the placenta without forming distinct rows. In these cases, when closely packed, they are mostly horizontal, and the tendency to ascend or to descend, as above distinguished, may be difficult to ascertain. In *Beaufortia* there is

a single, amphitropous, broad, almost orbicular ovule, peltately attached to the centre of the disk of an orbicular peltate placenta. This curious-looking arrangement strikes at first as a remarkable anomaly; but a careful examination shows in most species a pair of more or less abortive ovules near the upper margin of the placenta, concealed under the perfect peltate ovule, or sometimes shortly prominent in *B. decussata* and *B. squarrosa*. In the adjoining genus *Regelia*, these two upper ovules become perfect, as well as a fourth, collateral with the perfect one of *Beaufortia*, bringing the arrangement to the ordinary two rows of amphitropous ovules, all in this case peltate.

In the unilocular Chamælaucieæ the ovules are always more or less amphitropous, and in pairs or in two rows. In the subtribe Euchamælaucieæ the excentrical placenta, either short, basal, and free, or adnate to the wall of the cavity on one side, but not extending to the summit, shows pretty clearly that we have here a gynæcium reduced to a single carpel; and the placentation is thus normal. But in *Calythrix* and *Lhotzkya* (forming the subtribe Calythriceæ) the two ovules, although still amphitropous, are quite straight and collaterally affixed to a filiform placenta, attached to the base and summit of the cavity, but usually free from its walls, although sometimes excentrical; and the question arises, does this placenta represent the single placenta of the monocarpellary Euchamælaucieæ, or is it the reduced dissepiment of a bicarpellary ovarium with uniovulate cells, like that of some species of *Scholtzia*? And the problem is not satisfactorily solved by the examination of the three connecting genera, *Homalocalyx*, *Thryptomene*, and *Micromyrtus*, provisionally grouped in the third subtribe Thryptomeneæ. All three have the habit of *Bæckea*; *Homalocalyx* has the stamens of Calythriceæ with the placentation of Euchamælaucieæ; *Thryptomene* has the stamens of *Bæckea* with the placentation of Euchamælaucieæ; *Micromyrtus* has also the stamens of *Bæckea*, but with a placentation directly connecting Calythriceæ with *Scholtzia*.

Generally speaking, these modifications of the ovules and their placentation afford the best generic characters, the most in accordance with minor characters and general habit. I have analyzed the ovaries of nearly 600 Australian species, and generally from many different specimens of each, and have found no other organs so constant, provided too much weight be not attached to the precise form of the placenta, which is very variable in *Bæckea* and some other large genera. This importance of placentation

has also been well brought forward by Brongniart and Gris in their papers on New Caledonian Myrtaceæ, although it may be doubted whether it may not have led them rather too far in the distinction of genera allied to *Metrosideros*.

5. Fruit.

The fruit of Myrtaceæ gives very important general but not absolute characters, dividing well the whole order into four great types:—the small one-seeded indehiscent nut of Chamælaucieæ; the capsule opening loculicidally at the top of Leptospermeæ; the indehiscent berry, or rarely drupe, of Myrteæ; and the hard indehiscent or operculate, usually large or several-seeded fruit of Lecythideæ; but in each of these tribes there are exceptions—chiefly monotypic or very small genera, or isolated species. And beyond this general distinction it is very rarely that modifications of the fruit are at all available as generic characters.

6. Seed.

The seed, apart from the embryo, is also of very little avail. Its insertion, dependent on that of the ovule, is, of course, when undisturbed, equally important; but it is so frequently modified by the growth of the fruit, that it is always much safer to ascertain it at the time of flowering. The size and shape of the seed, the texture of the testa, its expansion into wings of various shapes, the presence of a small quantity of albumen or its total absence, are very rarely, as far as hitherto known, constant in large genera, and will probably be found still less so when more species shall have been examined.

We now come to the great character of the embryo, to the modifications of which the greatest importance has always been attached, owing, in some measure, to *à priori* reasoning, the danger of which is fully exemplified in Myrtaceæ. To this day I do not believe that the embryo has been seen in one-half of the published species of the order. There are considerable genera, of which I have had hundreds of specimens before me in various stages of flower or fruit, of which the embryo had never been described, and in which I have only been able to see it in two or three seeds, or in which it is still unknown; and the fallacy of presuming upon the embryo from analogy in other respects is shown by the numerous species which the most acute systematic botanists had placed in the wrong genus before the embryo was ascertained. In the tribe Myrteæ, indeed, if we get the ripe

fruit, we can generally find a perfect seed to examine; but in Leptospermeæ it is generally only one or two of the uppermost seeds of each cell that come to perfection; and those fall out the moment the capsule bursts, so that, in herbarium specimens apparently loaded with fruit, nothing is to be found but open capsules, either empty or full of abortive seeds of various sizes, presenting nothing but a hard mass of homogeneous matter.

The modifications in the form of the embryo are, however, so constant in species and, often, in large groups of the order, that the principal objection to taking them as absolute artificial characters is the practical one above-mentioned, of the frequent impossibility of observing them; and they are far from being always natural. The embryo is perhaps nowhere so diversified in a large natural family as in Myrtaceæ. Large cotyledons connected by a slight radicular protuberance, or all radicle* with the cotyledons minute or absolutely imperceptible before germination—nearly globular or long and slender embryos, either quite straight or variously bent, folded or spirally twisted—thick and fleshy, or broad and flat, or contortuplicate and leafy cotyledons are found in genera nearly allied in other respects, or even scarcely otherwise distinguishable. Still there are some peculiarities which, as far as observed, are so constant as to justify, in some degree, the high opinion entertained of their value, and requiring therefore some special notice.

In the few species of Euchamælaucieæ where I have been able to observe it, the embryo, under a thin testa, fills the cavity of the fruit, taking the general form of the calyx-tube. It presents an obovoid mass, the top nearly flat, upon which lies a slender appendage or neck, which I at first took to be the radicle till I observed in one case a minute notch at the point, showing that it is, on the contrary, the cotyledonar end, analogous to that of *Bæckea*. In the Calythricæ, always included among Chamælaucieæ, the embryo is quite straight, usually linear and terete, with short cotyledons at the upper end, although in two species it becomes broader, almost obovoid, with the short cotyledons at the upper broad end, not at the lower small end as in *Bæckea*. In the Thryptomeneæ, connecting Chamælaucieæ with Bæckeeæ, the embryo is only known in two or three species, where it is similar to that of *Bæckea*.

* I use the word *radicle* in the ordinary sense, designating the solid part of the embryo below the cotyledons, quite independently of the question of how much of it forms part of the descending axis.

This *Bæckea*-embryo has great analogy with that of the few Euchamælaucieæ where it is known, but in a somewhat reversed position. The general form is that of an obovoid mass with a small narrow recurved neck; but this neck, instead of lying flat on the upper broad end, is turned up from the lower more or less attenuate end, and much more distinctly divided into cotyledons at the tip. This is the general type, as far as is known, in *Bæckea*, *Scholtzia*, and *Micromyrtus*, varying in different species in the neck longer or shorter, straight or transversely folded or twisted, and in the degree of development of the cotyledons. In *Astartea* the embryo is probably the same, but as yet unknown.

The next general type is that of *Leptospermum*. The radicle has lost its predominance; it is straight, linear, and terete, as in *Calythrix*, but usually reversed, and smaller than the flattened cotyledons, although not so much so as in some other genera. Between *Bæckea* and *Leptospermum* we have placed three genera—*Hypocalymma*, *Balaustion*, and *Agonis*. In the first, *Hypocalymma*, the stamens are nearly those of *Leptospermum*, of which Endlicher made it a section, the foliage that of *Bæckea*, and the embryo, as far as known, nearer to that of the latter genus than of *Leptospermum*, being a thick obovoid mass, the lower somewhat attenuate end either straight and entire or very minutely incurved and notched; but I have only succeeded in examining three good seeds in the whole genus. In *Balaustion* the embryo is entirely unknown. The third intermediate genus, *Agonis*, frequently referred as a section to *Leptospermum*, which it sometimes resembles in foliage, has the stamens of *Bæckea*, with the inflorescence, ovules, and seeds of *Melaleuca*, with which it also agrees in the embryo, the cotyledons much larger, and the cotyledons much smaller in proportion than in *Leptospermum*.

The remaining genera of Leptospermeæ, as far as known, have one general type of embryo, varying often more in species of the same genus than in different genera. The cotyledons are always larger and broader than the cylindrical radicle, but in various proportions. The radicle is superior or inferior according to the insertion of the ovule near the summit or near the base of the cavity of the ovary; it is sometimes nearly as long as the cotyledons, and straight with them or turned down over them, or very short. The cotyledons are sometimes oblong, thick, and almost semiterete, sometimes thick and hemispherical, or broad and flat, or thin, very broad, conduplicate over the incumbent radicle, or contortuplicate. They may be entire or more or less

deeply notched at the insertion of the radicle. In most *Eucalypti* this notch is so deep as completely to divide each cotyledon into two broad conduplicate plates enveloping the radicle. In the large and natural genus *Melaleuca* there are species with narrow and with broad cotyledons, flat or variously folded, very frequently the two cotyledons so folded that each one embraces one half of the other.

The tribe of Myrteæ proper, after abstracting a few anomalous monotypic or very small genera, comprises, according to the lowest estimate, above a thousand species, which some botanists have multiplied to nearly twice that number, all with so little diversity of floral structure and habit that, without the aid of the embryo, they might well have been included in one natural genus. The embryo, however, presents three remarkable types, which, when first observed, were supposed not only to be widely and constantly distinct, but also to correspond with differences in the number of parts of the flower, in the texture of the testa, and other minor characters, and they were gladly seized upon as absolute tests of three great genera or subtribes. These are:—1, the horseshoe-shaped, circular, or spiral embryo of *Myrtus*, *Psidium*, and their allies, consisting of a long terete radicle, with two very small cotyledons at the inner end; 2, the broad, thin, very much folded or contortuplicated cotyledons of *Myrcia*, more or less surrounded by the curved terete radicle; and, 3, the thick fleshy embryo of *Eugenia*, sometimes apparently homogeneous, but more frequently showing the line of separation of two thick hemispherical cotyledons, connected by a very short radicle. Relying upon these characters maintaining throughout the constancy observed in the very few species which he could examine, DeCandolle was enabled to make an apparently excellent distribution of the great mass of succulent-fruited Myrteæ into the three principal groups above mentioned. It was further believed that, as between the three typical genera, *Eugenia*, *Myrtus*, and *Myrcia*, the former might always be known by its 4-merous flowers, and that the latter two, with 5-merous flowers, might be distinguished by their inflorescence and the number of ovules. Further observation has not, however, confirmed this neat demarcation. A large number of South American, especially Chilian species which, from their 4-merous flowers, had been placed in *Eugenia*, prove to have the embryo of *Myrtus*; the cymose, well-developed inflorescence sometimes accompanies the embryo of *Myrtus* as well as that of *Myrcia*; and a few instances are known of embryos intermediate in form

between the typical ones. The embryonic character in the fleshy-fruited Myrteæ is therefore more artificial than was supposed, and is only retained for want of a better one. *Myrcia*, indeed, can generally be known by the ovules, two only in each cell, whilst they are more numerous in *Myrtus* and in *Eugenia*; but the two latter genera, when the peduncles are 1-flowered, have nothing but the embryos to separate them. When several-flowered, the American Eugenias are racemose, the Myrcias and Myrtuses cymose, as well pointed out by Grisebach. The Asiatic and African many-flowered Eugenias are, it is true, cymose; but there are there no Myrcias or many-flowered Myrtuses to confound with them. The Australian Eugenias are chiefly of the Asiatic type; but there are some species of *Myrtus* with the inflorescence of the American Eugenias, obliging us thus to depend solely upon the embryonic character irrespectively of geographical origin.

In Lecythideæ the diversity of embryo, in the ten genera in which it is known, is as great as in either of the other tribes. In *Barringtonia* and *Careya* it is a hard, thick, undivided mass, with a line down the centre, which had been supposed to be the indication of a separation between two cotyledons, until it was shown by Thomson (Journ. Linn. Soc. ii. 47) to be of a pithy nature, and that the real cotyledons are abortive. In *Gustavia* and *Napoleona* the embryo, as in *Barringtonia*, is thick and hard, or fleshy, filling the seed, but, as in *Eugenia*, it consists of two distinct cotyledons with a small radicle. In *Lecythis* and *Bertholletia*, again, we have the same thick mass, but without any indication, as far as hitherto observed, whether it is all radicle without cotyledons, as in *Barringtonia*, or almost all cotyledons with a very small radicle, as in *Gustavia*. In *Planchonia*, otherwise closely allied to *Gustavia*, and in *Lecythopsis*, otherwise closely allied to *Lecythis*, as well as in *Couratari* and *Couroupita*, the cotyledons are much folded, and surrounded by a very long, folded or spiral radicle. In *Petersia*, *Grias*, and *Asteranthos* the seeds are unknown.

Whilst, therefore, the embryo in Myrtaceæ still retains a very high position in the scale of generic characters, we find that when we rely upon it as absolute, as we are compelled to do sometimes for want of a better one, our genera may become artificial, and that in some cases, as in *Melaleuca*, we are obliged to place it below staminal and some other characters.

7. Organs of vegetation and flower in general.

The organs of vegetation, in this as in other large Orders, without supplying absolute characters, afford very useful indications in distinguishing the Order itself from those nearest allied to it, as well as in the distribution of some of the groups.

The stem is always more or less woody, at least at the base. There are no herbaceous genera or species, as occurs in Lythrarieæ and Melastomaceæ, and scarcely any suffrutescent. Nearly all, or perhaps all when arrived at their full growth, are shrubs or trees.

The leaves are always opposite in Myrteæ, opposite, alternate, or scattered in Chamælaucieæ and Leptospermeæ; and in these three tribes the leaves as well as other herbaceous parts are almost always, perhaps always, glandular-dotted; for in the few species in which the dots are said not to exist, I have usually found them when I have seen the young leaf, before they become concealed by the density of the texture of the full-grown coriaceous leaf; and these dots do not exist in the Orders most nearly allied to them in floral characters. The tribe Lecythideæ, however, has alternate leaves without dots; but in them the floral characters are exclusively Myrtaceous. The leaves are always entire, or very rarely obscurely crenate; their shape and venation is various; but the peculiar venation of Melastomaceæ exists only in two very small genera of Myrteæ—*Rhodamnia* and *Rhodomyrtus*. A few subtribes and genera affect a peculiar foliage, which assists in their determination, but not in general within any definite limits.

The general character of the Order is to have no stipules. In the very few cases where they are found, they are so very minute and fugacious that they can only be regarded as rudimentary.

Inflorescence, although it can scarcely be taken as an absolute character, is often one of the best indications of generic affinity. In the great majority of Chamælaucieæ, in Euleptospermeæ and Beaufortieæ, and in several genera of other tribes or subtribes, it is simple, the growth and ramification of the flowering-axis does not differ from that of the foliage-axis; each flower is solitary in the axil of the floral leaf or subtending bract, sessile or pedicellate, with a pair of bracteoles, more or less conspicuous under the flower, without any floral buds in their axils. When the flowering-nodes are distant, the subtending leaves often do not differ from the other stem-leaves, although even then they are sometimes

more or less altered in size, shape, or colour; but when the flowers are so crowded as to form a head or spike, the floral leaves are usually reduced to bracts, either small and concealed by the enlarged bud when ready to open, or larger and imbricate in the bud, and falling off as the flower expands. In some cases the lower bracts or floral leaves of the spike, together with a few empty ones immediately below the spike, are enlarged, imbricate, dry, and scale-like, or coloured and petal-like, forming an involucre under or enclosing the spike. Occasionally a few of the upper floral leaves are coloured and enlarged into a crest crowning the spike. And in the great majority of those Myrtaceæ which have a capitate or spicate inflorescence, the axis, after the flowering is over, or even at an earlier period, continues to grow beyond the spike, producing, instead of floral leaves, stem-leaves like those below it. This explains the numerous cases where the flower-heads are all strictly terminal, whilst the fruits form clusters surrounding the base of the year's shoots.

In these simple inflorescences the flowers are constantly closely sessile in *Melaleuca* and several allied genera, more or less pedicellate in *Bœckea* and others; but the same character is variable in *Leptospermum*, *Kunzea*, &c., where, indeed, it often happens in one species that some flowers, especially females, are closely sessile, whilst others, especially males, are pedicellate.

The racemose inflorescence of American *Eugeniæ* must also be regarded as simple. The axillary raceme is a reduced branch, and often grows out, like the spike of Euleptospermeæ, into a normal leafy branch,—a circumstance upon which Berg's genus *Stenocalyx* was chiefly founded, but which forms but a very vague generic character. The racemes of Lecythideæ are more determinate; and although their ramification be the same in principle as that of the leaf-branches, there is this difference, which appears constant, that the rachis never grows out into a leafy branch.

In the truly compound inflorescences of Myrtaceæ, buds are produced in the axils of the bracteoles, developing each a single flower or a several-flowered branch, producing thus the determinate centrifugal cyme. This inflorescence occurs in Myrteæ, Metrosidereæ, and Bæckeeæ, but not in other tribes or subtribes, except rarely in *Thryptomene*, otherwise nearly related to *Bœckea*. Within the tribes the compound inflorescence is often characteristic of large groups, and assists in the distinction of genera (as, for example, in separating many-flowered *Myrti* from American *Eugeniæ*), but it is rarely absolute throughout a genus.

In Eucalypteæ the cymes are altered to umbels, either solitary or several together on a common peduncle forming a panicle—a constant character even in the few species allied to *E. tessellaris*, where the inflorescence is disguised by the umbels being reduced each to two or three flowers, and crowded several together on a common peduncle, or in a few other species, as in *E. eximia*, where, the flowers being sessile, the umbel is reduced to a head.

In Metrosidereæ the inflorescence, almost always compound, is often variable or irregular. Usually cymose, the cyme sometimes passes into the umbel or into the raceme, connecting occasionally in one genus the several inflorescences so distinct in other cases.

The variations in size, shape, colour, persistence, &c. of bracts and bracteoles, usually constant in species, and often much affecting the general aspect of the plant, have been sometimes made use of for generic distinction. It has, however, appeared to me that they can never be safely relied upon, except as serving for a purely artificial distribution of species, as, for instance, in *Darwinia*.

The flowers are more or less unisexual in many Myrtaceæ, especially in the tribe Leptospermeæ; but although this is more frequently the case in some genera than in others, the circumstance can never be taken as a generic character. The unisexuality is never, perhaps, absolute, and varies much in degree, even in different varieties of the same species.

I shall now proceed to consider the several tribes and genera adopted in our 'Genera Plantarum,' and offer a few remarks on the limits we have been induced to assign to them.

Tribe I. Chamælaucieæ.

When Chamælaucieæ were chiefly known by the genera *Calythrix* and *Verticordia*, and when all the species ranged under *Bæckea* were supposed to have a perfectly 2- or 3-celled ovary, the differences between Chamælaucieæ and other Myrtaceæ appeared very striking; and Lindley (Veg. King. p. 721) raised them to a distinct Order, "on account of their very peculiar aspect, which resembles nothing among Myrtleblooms, except some Bæckeas, their remarkable abortive stamens, their simple ovary, which never indicates a trace of being formed by the adhesion of more carpels than one, and their pappose calyx." Since then, however, the careful examination of all the varied forms assumed by species of *Bæckea* and Bæckea-like plants,

the comparison of their ovaries with those of Chamælaucieæ, and the discovery of many new connecting links have shown that the two groups can no longer be separated as distinct Orders. Their peculiar aspect passes gradually into that of *Bæckea*, *Leptospermum*, and their allies, and is a little departed from in a few of the larger-leaved Darwinias; their ovary (which remains the chief character of the tribe) does not appear to be always so really simple as was supposed; for the peculiar filiform placenta of *Calythrix* attached to the base and summit, as well represented in Lindley's fig. 2 (Veg. Kingd. p. 721), is shown by a comparison with that of some Scholtzias to be most probably a reduced dissepiment, in which case the two ovules would belong to two carpels; the abortive stamens are only in 4 genera, including 71 species, whilst they are all perfect in 7 genera, including 72 species; and the calyx-lobes can scarcely be compared to pappus-scales, except in the two large and striking genera *Calythrix* and *Verticordia*. We have therefore now reduced Chamælaucieæ to a tribe of Myrtaceæ, somewhat artificially characterized by the one-celled ovary. In other respects there appear to be more grounds for separating *Calythrix* and *Lhotzkya* from the remainder of Chamælaucieæ than for removing some genera of the latter, especially *Thryptomene* and *Micromyrtus*, from the true Bæckeeæ.

Actinodium, Schau., with which the series of genera is usually commenced, is a single species which has all the aspect of *Darwinia*, and might well have been included in that genus without interfering with the characters which separate it from others. It is maintained, however, to avoid the extension of the character of the larger genus in two remarkable instances: the flowers are 4-merous in *Actinodium*, always 5-merous in *Darwinia*; and none of the numerous species of the latter genus show any tendency towards the remarkable outer ring of barren flowers of *Actinodium*.

I have already had occasion to lay before the Society the history of the genus Darwinia, Rudge, in a paper printed in the Journal, vol. ix. p. 176. Since that time I have been enabled, through the kindness of Dr. Fenzl, of Vienna, to ascertain that the genus *Francisia*, Endl., was founded on a drawing of Bauer's of the original *Darwinia fascicularis*, Rudge. There is also every reason to conclude that a cultivated plant of the same species, of which no specimen was preserved, supplied F. Mueller's MS. description of *Cryptostemon fascicularis*, published by Miquel (Nederl. Kruidk. Arch. iv. p. 115).

HOMORANTHUS, A. Cunn., is a single species which has scarcely even the claims of *Actinodium* to be excluded from *Darwinia*, differing from the latter genus only in the subulate calyx-lobes. Its retention may, however, be justified as facilitating the distinction between *Darwinia* and *Verticordia*.

VERTICORDIA, DC., contains at present 37 species, showing considerable diversity in the structure of the anthers as well as in the ovules, and connected together by the single character of the dissected or plumose calyx-lobes; but this character gives so peculiar an aspect that it is justly allowed to supersede all others, and the genus is universally acknowledged in its integrity. The only separation proposed was Lindley's *Chrysorrhoë*, in the original species of which a very singular form of anther was observed to be connected with the bright-yellow flower. Subsequent researches, however, have shown in other species a gradual passage from these singular-shaped anthers to one of the two normal types of the genus, and that they do not correspond at all with the colour of the flower; and *Chrysorrhoë* was very soon given up even as a section. The division of *Verticordia* into two artificial sections, by the same characters which supply the more natural separation of *Darwinia* from *Chamælaucium*, has been already alluded to; and further details on the arrangement of the species are now superseded by the 'Flora Australiensis.'

PILEANTHUS, Labill., is an old genus of two or three species, characterized, again, chiefly by the calyx, in which accessory lobes are produced from the sinus precisely resembling the primary ones, the whole ten being broad, petal-like, and spreading, giving the calyx a shuttlecock-aspect, accompanied also by a conversion of the staminodia into stamens, thus doubling the number of perfect stamens as well as of calyx-lobes. As the petals remain limited to the normal number of five, we have no reason to suppose that the calyx is really composed of more than five sepals, and conclude that the accessory lobes are, as already mentioned, a mere expansion of the joint-nerve, produced by the union of two lateral nerves of two adjoining sepals. The other characters and habit of *Pileanthus* are those of *Chamælaucium* and *Verticordia*.

CHAMÆLAUCIUM, Desf., the first-established genus of the group, closes the remarkable and very distinct series of Chamælaucieæ proper, and, as already observed, is distinguished from *Darwinia* by the anthers, and from the other genera by the calyx. It has been generally recognized in its true limits, the only separation proposed being by Turczaninow, who described one species as a new

genus, under the name of *Decalophium*: but that was probably from ignorance of the true *Chamælaucia*; for he at the same time published the original *C. ciliatum*, Desf., as a new *Genetyllis*.

Calythrix, Labill., and Lhotzkya, Schau., with the habit of Chamælaucieæ, and therefore included in them by all botanists, have nevertheless some peculiarities of structure which distinguish them much more from the above-mentioned genera than from some Leptospermeæ. The stamens, always indefinite and in several rows (or very irregularly 1-seriate), even when reduced to below 10, are unknown in Euchamælaucieæ, and only found in *Homalocalyx* among Thryptomeneæ; the peculiar placentation and embryo have already been alluded to. All these characters, if not strictly intermediate between those of Chamælaucieæ and Leptospermeæ, show a rather more general affinity to the latter than to the former; yet the technical character derived from the unilocular ovary, and the general aspect given by foliage and inflorescence, oblige us to retain them in the tribe of Chamælaucieæ.

Calythrix is the principal genus amongst Myrtaceæ in which minute, almost hair-like bodies, at the base of the leaves of a few species, have been described as stipules. If they are really to be considered such, which may be as yet somewhat doubtful, they are quite rudimentary, and so uncertain in the few species where they have been observed as to be useless for systematic description, whilst at the same time they appear to perform no function in the economy of the plant.

The name *Calythrix* has been objected to by some German purists, and altered to *Calycothrix*, as being derived from κάλυξ and θρὶξ; but the elision of the hard terminal consonant of *calyx* in composition, if not classical, has received the sanction of botanists in other cases, as in *Calydermos*, *Calystegia*, &c., besides having been fixed in the present case by the right of priority. At any rate, if strict rules of etymology were followed, the alteration would be to *Trichocalyx* (a name already preoccupied), not to *Calycothrix*; for the meaning intended to be conveyed was *hair-like calyx*, not *calyx-like hairs*.

With regard to the separation of *Lhotzkya* from *Calythrix*, as proposed by Schauer, there has appeared to me no inconvenience in maintaining it, although in opposition to the more recent views of F. Mueller. The constant want of any point or awn to the calyx-lobes, in all the eight species known, give it a very distinct aspect; and there can be no difficulty about the supposed inter-

mediate species (*Calythrix brachychæta*, *C. achæta*, and *C. laricina*); for in all three the awn, although short, fixes at once their place in *Calythrix*.

Under the subtribe Thryptomeneæ I have included three genera, HOMALOCALYX, F. Muell., THRYPTOMENE, Endl., and MICROMYRTUS, Benth., which, in aspect, and as far as is known in their seeds, differ but little from *Bæckea*, in which the few early known species were included, until the discovery of their unilocular ovarium induced their removal to Chamælaucieæ. Even since the importance of this character has been pointed out, several of these *Bæckea*-like Chamælaucieæ have been first published as Bæckeas or as Scholtzias, the impatient anxiety of species-makers to establish their new names preventing their previously examining the structure of these minute flowers with the necessary care.

With regard to the three genera adopted in the 'Flora Australiensis,' F. Mueller is now disposed to unite them into one, although the first, *Homalocalyx*, was originally proposed by himself upon characters which appear to me to be substantial, it having the stamens of *Calythrix* and *Lhotzkya* with the ovary of *Chamælaucium*. Of the two species, however, which I have brought under it, one, *H. polyandrus*, F. Muell., is as yet only known from somewhat imperfect and perhaps abnormal specimens; and of the original one, *H. ericæus*, F. Muell., we have not yet the ripe seed, which may further confirm or possibly invalidate the genus. The principal genus, *Thryptomene*, now consisting of 17 species, has the habit and almost the stamens of *Bæckea*, with the ovary of *Chamælaucieæ*. It was originally established by Endlicher on a then unpublished species. To this Schauer added the *Bæckea saxicola*, A. Cunn., which he had previously separated from *Bæckea*, under the name of *Astræa*, and which has since been somewhat carelessly published by Baillon under the name of *Eremopyxis* (mistaking it for *Bæckea camphorata*, Br.), and by F. Mueller as a new *Scholtzia*. The third species known to Schauer was established by him as a distinct genus under the name of *Paryphanthe*, founded chiefly upon the number of stamens, 5 instead of 10—a character which, in the five species in which it occurs, is unaccompanied by any other difference in character or habit, and therefore at most sectional. The third genus, *Micromyrtus*, was first established in the 'Flora Australiensis.' It is certainly very near to *Thryptomene*; but the differences there indicated in the ovules and placentation, in the very deciduous petals, in the position of the stamens when reduced to 5, and possibly in the seed, appeared to me to be so

combined as give greater facilities for the general arrangement of the Order if treated as generic than as sectional.

Tribe II. Leptospermeæ.

The long series of 2- or more-celled capsular genera forming the tribe Leptospermeæ are nearly all Australian, and most of them exclusively so, or at most emitting a few species into New Zealand, New Caledonia, or some of the islands of the Indian archipelago and the Pacific; and most of them, although perhaps not quite so vague as the baccate Myrteæ, yet pass into each other through intermediate species which render their delimitation much more difficult than in the case of Chamælaucieæ. On the other hand, some of the differential characters are so striking, that, if the ambiguous species were overlooked, there would appear to be several well-marked subtribes. The first one especially, the Bæckeæ, has always, as far as known, the minute cotyledons of Chamælaucieæ, accompanied usually by opposite leaves and definite or uniseriate stamens; whilst in the following subtribes the cotyledons are as long as or longer than the radicle, the stamens usually indefinite, and 2- or pluri-seriate, with varying leaves. The apparently positive character of the embryo remains, however, to be confirmed in some intermediate species, of which the ripe seed is unknown.

Scholtzia, Schau., which I have placed first, as connecting *Micromyrtus* with *Bæckea*, is so near the latter genus as to have been made a section of it by De Candolle. It also shows both the forms of anthers prevalent in *Bæckea*. As, however, the arrangement of the ovules, 2 superposed in each cell, is accompanied usually by a rather peculiar inflorescence, and as some species, by their apparently incomplete dissepiments of the ovary, show an approach to *Micromyrtus*, it has been thought convenient to maintain the genus as distinct. *Piptandra*, Turcz., has no character whatever to distinguish it from other species of *Scholtzia*, which have constantly, or occasionally, 3 cells to the ovary.

The typical genus, Bæckea, Linn., was originally supposed to be well characterized by definite stamens and a 2- or more-celled ovary with a heath-like habit; but as numerous exceptions have been successively discovered, it has been variously understood by different botanists. Some include *Thryptomene*, *Micromyrtus*, *Scholtzia*, and *Astartea*, all of which have a similar habit, but with structural differences, which may justify their maintenance as

distinct. Others, again, have broken up what remains of the genus into eight or nine small ones; and, as long as only a few species showing remarkable differences in the anthers, ovary, &c. are taken into account, that course would seem justifiable; but on a repeated examination of about 45 species as we understand them, or of above 60, if all those proposed by Schauer, Miquel, and others be adopted, the differences have been observed to pass so gradually from the one to the other, that, even as sections, the best groups we have been able to establish are but vaguely defined or purely artificial. Of these sections we have adopted six, for which we have taken the names of Schauer's genera, *Rinzia*, *Euryomyrtus*, *Schidiomyrtus*, *Harmogia*, and *Oxymyrrhine*, and of Lindley's *Babingtonia*, all of them founded upon single species (except *Harmogia*, which had three) now placed in the corresponding sections, but with sectional characters necessarily very much modified by the grouping around them of additional species.

The most constant character we have found to divide the genus into two groups is one which appears to have been overlooked by Schauer. In *Rinzia* and *Euryomyrtus* the stamens are never reduced below ten, and amongst them there is always one opposite to the centre of each petal, usually larger than the others, or with a more flattened filament; whilst in the other four sections the stamens are much less definite in number, varying from under 5 to above 30, and none are opposite to the centre of the petals, except perhaps in *B. polyandra*, where they are very numerous. Some other characters are general, but not constant, in the two divisions. The ovules are reduced to 2 or 3 in each cell in several species of the first, never in the second; the anthers are uniformly parallel-celled and rimose in the first, heteromorphous in the second. The ovary, as observed by Schauer, is superior, or nearly so, in the original *Rinzia* and one other species, half superior in three others, and almost entirely inferior in *B. dimorphandra*, which cannot otherwise be removed from *Rinzia*. The section, indeed, is only distinguishable from *Euryomyrtus* in the remarkable dilatation of the filaments, *B. diffusa* alone in *Euryomyrtus* showing some approach to it.

The four sections of the second division are technically, but unfortunately not very definitely, distinguished by the anthers; the cells are (as in the first division) distinct, parallel, and rimose in *Schidiomyrtus*, united and porose in *Babingtonia*, intermediate in *Harmogia* and *Oxymyrrhine*. The ovary is also 2-celled in all the species of *Schidiomyrtus*, except *B. astarteoides*, 3-celled in the

other three sections. Of the two intermediate sections the anthers of *Harmogia* approach nearest to those of *Schidiomyrtus*, and the species are all eastern; whilst the anthers of *Oxymyrrhine* tend rather towards *Babingtonia*, and the species are all western. So little, however, do the last three sections really differ from each other that when new species have been discovered they have been placed indiscriminately in the one or the other; and F. Mueller has in several instances published them at once as Bæckeas, as Harmogias, and as Babingtonias, giving his readers the option as to which name to select. Of the additional genera proposed, *Camphorosma*, Schau., does not appear to me to differ in the slightest degree from *Harmogia*, and *Tetrapora*, Schau., and *Ericomyrtus*, Turcz., to be inseparable from *Babingtonia*. The common *Bæckea fruticosa* of the Indian archipelago is not exactly represented in Australia, although *B. stenophylla*, F. Muell., from Queensland, comes very near to it. The three or four New-Caledonian species comprise varieties of *B. virgata*, which is widely spread in Eastern Australia, and is there very variable, and a few forms nearly allied to it, but which may be constant enough to be maintained as species.

The following small genus, ASTARTEA, DC., is separated from *Bæckea* by the purely artificial character of the stamens collected in bundles or clusters, on which account it had always been placed in a different subtribe, next to *Melaleuca*. This, however, appears to be a mistaken view of real affinities. The clusters or bundles of stamens in *Melaleuca* and its allies are always opposite to the petals, whilst in *Astartea* they alternate with them, the arrangement thus corresponding with that in those polyandrous species of *Bæckea* in which the ring of stamens is interrupted opposite to the petals. Indeed the *Astartea ambigua*, F. Muell., shows so nearly the staminal arrangement of *Bæckea*, and the aspect of the whole genus is so *Bæckea*-like, that it is kept up rather in deference to general usage than from its intrinsic value.

HYPOCALYMMA, Endl., in its more numerous stamens, and sometimes in inflorescence, assumes the aspect of *Leptospermum*, and it was first published as a section of that genus; but the opposite leaves and the inflorescence of some species connect it with Bæckeeæ, where also it is more decidedly placed by the embryo, if, indeed, it be constantly similar to that of the only species of which the perfect seed has been examined.

BALAUSTION, Hook., published also by Drummond under the name of *Cheynia*, has most of the floral characters as well as the

foliage of the polyandrous Bæckeas, with which F. Mueller thinks it should be united; but the large coloured calyx gives to the single species so peculiar an aspect, that we were unwilling to suppress the genus, so long, at any rate, as the fruit and ripe seeds shall remain unknown.

The remaining Leptospermeæ have, as far as known, the cotyledons always as long as or longer than the radicle; and the stamens, when not forming a regular ring, are (except in *Agonis*) gathered in clusters or bundles opposite to the petals, and interrupted opposite to the sepals, whilst the reverse has been seen to take place in the polyadelphous Bæckeeæ. They comprise four groups or subtribes, viz.:—(1) EULEPTOSPERMEÆ and (2) BEAUFORTIEÆ, agreeing with each other in their small or narrow coriaceous leaves, and almost universally closely sessile flowers, but differing in the anthers, versatile in Euleptospermeæ, erect and fixed by the base in Beaufortieæ; (3) EUCALYPTEÆ, usually with large leaves and pedunculate, mostly umbellate flowers, and remarkable for the truncate calyx and broad truncate base of the petals, whether united in a calyptra or separately deciduous; and (4) METROSIDEREÆ, which have myrtle-like or large leaves and pedunculate flowers, with the petals rounded or contracted at the base, as in Euleptospermeæ.

The EULEPTOSPERMEÆ comprise four genera with free stamens, and three with polyadelphous ones. The first one, AGONIS, DC., agrees in its alternate leaves and short stamens with *Leptospermum*, of which it was formerly considered a section; but the arrangement of the stamens is exceptional in the subtribe, being precisely that of Bæckeeæ, whilst the inflorescence and ovary are nearer to those of *Melaleuca* than of *Leptospermum*. The seeds also, as far as known (for they have been seen in three only of the ten species), agree with *Melaleuca*, and prevent our ranking *Agonis* amongst Bæckeeæ; we have therefore placed it at the commencement of Euleptospermeæ as a connecting link between the two subtribes.

LEPTOSPERMUM, Forst., is an old genus, which we found in a singular state of confusion. In the first place, it long formed a common receptacle for all capsular Myrtaceæ with small coriaceous leaves and numerous short stamens. Again, a few common species, scarcely distinguishable by any positive characters, are yet so polymorphous, especially in our gardens, as to have been enormously multiplied by horticultural botanists, whilst almost all those which showed any tangible specific differences

have been at various times proposed as distinct genera. And, lastly, notwithstanding the facility of examining living specimens of several species common in our plant-houses, errors in some of the important characters originally misunderstood have been servilely copied by almost all modern botanists.

After removing a few true Bæckeas, which the older authors had included in *Leptospermum*, and adopting as genera the sections *Hypocalymma*, Endl., with a Bæckeoid foliage and probably embryo, and *Agonis*, DC., with Bæckeoid stamens and erect ovules, both with the inflorescence of *Melaleuca*, there remains a not unnatural group, differing from *Kunzea* and *Callistemon* chiefly in the stamens not exceeding the petals, and including the genera *Fabricia*, *Macklottia*, *Homalospermum*, and *Pericalymma*, proposed or adopted by modern monographists.

Fabricia was characterized and figured by Gærtner as having a single winged peltate seed, filling each cell of the capsule; but this was a mistake. The ovules in both his species are exceedingly numerous. It is true that, as in some other species of this and allied genera, only one or two in each cell form perfect seeds, the remainder either remaining small and abortive, or more or less enlarging into linear or misshapen barren seeds, and that in the *Fabriciæ* the perfect ones are broad and acutely angular, or more or less winged, whilst in typical Leptospermums the perfect as well as the barren ones are narrow-linear; but this appears to be rather a sectional than a generic character. Gærtner's error was owing to the fruits he examined in the Banksian collection having been unripe, with the valves opened in dessication, as frequently happens in woody-fruited Myrtaceæ. In this state the unripe ovules, with the placenta, readily detach themselves in a peltate mass, which Gærtner mistook for, and figured as, the seed, without dissecting it. Gærtner's two species of *Fabricia* have, moreover, usually ten cells to the ovary, whilst the typical Leptospermums have five or fewer; but this distinction is not constant. The *Fabricia coriacea*, F. Muell., since reduced by that author to a variety of *Leptospermum* (*Fabricia*) *lævigatum*, has from six to eight cells, and *Homalospermum*, Schau., a single species, with the seeds and other characters of the section *Fabricia*, has always four cells to the ovary.

The typical *Leptosperma* (section *Euleptospermum*), with numerous ovules and linear seeds, comprise a long series of forms, which, according to Schauer, or to the earlier views of Mueller, as published by Miquel, or to several horticultural botanists, would

constitute between thirty-five and forty, or even more, species; but their characters are exceedingly vague and variable, and they appear all to be connected by an almost infinite series of intermediate gradations. In arranging the large mass of specimens I had before me, for the 'Flora Australiensis,' I thought I could distinguish twelve types which might rank as species, besides two rather more distinct ones with 3-celled ovaries; but it must be confessed that the characters of those twelve are often unsatisfactory, and a much further reduction, as now proposed by F. Mueller, might well be justified, even though it might lead to the uniting the whole twelve into a single one.

The *Leptosperma* from the Indian archipelago belong to the same series as the twelve Australian ones; and one of them, *L. amboinense*, DC., appears indeed to be identical with the Australian *L. flavescens*, Sm. They are proposed by Korthals as a distinct genus under the name of *Macklottia*. He does not say upon what grounds; for he gives no amended character of *Leptospermum*; but from that of his *Macklottia* it is probable that he founded it on the imbricate calyx-lobes, previous authors having described them as valvate, an error adopted by Blume in his detailed character of the archipelago species; and even Miquel (Fl. Ind. Bat. i. pars 1. p. 403), in reducing *Macklottia*, says, "Calycis . . . limbi . . . laciniis æstivatione haud imbricatis." I have, however, in both the archipelago species, as well as in all others, found the calyx-lobes constantly imbricate in the bud, as described by Korthals.

The three remaining *Leptosperma*, all from South-west Australia, form the section *Pericalymma*, Endl., characterized by a reduced number of ovules and a peculiar habit. Schauer, in raising the section to generic value, includes in the characters the 3-celled ovary; but that, as has been seen, occurs in two species of *Euleptospermum* with numerous ovules. As, moreover, the three species of *Pericalymma* are not very definitely distinguished, it may turn out that they form rather a single species of *Euleptospermum* than a sectional group.

Kunzea, Reichb., differs from *Leptospermum* in its exserted stamens, on which account the species formerly known were referred to *Metrosideros*; but the foliage, inflorescence, and structure of the ovary are entirely as in *Leptospermum*, and some of the smaller-flowered species have the stamens sometimes so little exserted as almost to pass into that genus. From *Callistemon* *Kunzea* differs usually in the shorter stamens, the capitate, not

spicate inflorescence, and especially in the ovules, pendulous as in *Leptospermum*, not ascending as in *Callistemon*. This character in the typical section *Eukunzea*, where the ovules are not very numerous, is very definite; but in a second section, for which I have extended Lindley's name of *Salisia*, the ovules are so densely crowded as to be thrown into a horizontal position, or the upper ones slightly ascending and the lower ones alone really pendulous, thus passing into the arrangement of ovules observable in some specimens of *Callistemon*, where they are equally crowded. *Kunzea Baxteri*, Schau., approaches *Callistemon* also in the colour of the stamens, and to a certain degree in inflorescence, and has, indeed, been published as a *Callistemon*, first by Lindley, and afterwards by F. Mueller, and as a distinct genus (*Pentagonaster*) by Klotzsch; but, from the 5-celled capsule, crowned by the large persistent calyx-lobes, together with the habit and foliage, it would appear to have been better placed by Schauer in *Kunzea*. *K. sericea*, Turcz., is another somewhat anomalous species: the flowers are large, and more unisexual than in other species: the male inflorescences form clusters rather than heads; and, prompted by its apparent beauty, as compared with *Leptospermum*, it was proposed as a genus, under the name of *Salisia*, by Lindley. There appears, however, to be no essential character to separate it from *Kunzea*. The female flowers are solitary and sessile; and it is a fruiting specimen, retaining only three solitary capsules, that Labillardière figured as *Leptospermum sericeum*, whilst he appears to have described the flowers from a specimen of *Leptospermum lanigerum*.

Callistemon, Br., also included by the older authors in *Metrosideros* upon purely artificial grounds, was early removed by Brown as being more nearly allied to *Melaleuca*, with which F. Mueller now proposes to unite it. It appears, however, to be more convenient to retain it as a small natural group, connecting *Kunzea* (and, through *Kunzea*, *Leptospermum*) with *Melaleuca*. We have already seen how it passes into the former through *Kunzea Baxteri*; and on the other hand, whilst it is generally distinguished from *Melaleuca* by the free stamens, there are some forms of *Callistemon lanceolatus*, and especially of *C. speciosus*, where they are more or less distinctly united in clusters at the base, whilst in a few Melaleucas the union in clusters is so short as to be scarcely perceptible. The species of *Callistemon*, estimated by some botanists at about eighteen, but reduced in the 'Flora Australiensis' to ten, are scarcely to be distinguished from

each other but by vague characters of degree in the breadth and consistence of the leaves, in the indumentum of the inflorescence, and in the colour of the stamens.

MELALEUCA, Linn., which, after *Eucalyptus*, is the largest genus of capsular Myrtaceæ, is also a very natural one, so much so, indeed, that all attempts to divide it into good subgenera have failed. It is also very well defined by its exserted stamens united in bundles opposite to the petals and bearing versatile anthers, only passing into *Callistemon* by a very few intermediate forms; and two species only have been proposed as separate genera: one, *M. teretifolia*, Endl., is the *Gymnagathis* of Schauer, without any character at all, for the inflorescence on which it is supposed to have been founded is that of many other species; the other, *M. angustifolia*, Gærtn., or *Asteromyrtus*, Schau., has, with two other species, the calyx-limb falling off after flowering in a circumsciss ring—a character unaccompanied by any other or by any difference in habit, and therefore not available further than for an artificial section. The coherence of the fruiting calyces, which was also relied upon, is not constant in either of the three species. A few species of *Melaleuca* are exceptional in the subtribe Euleptospermeæ by their opposite leaves, but cannot constitute even a distinct section, as they belong to very different natural series. One species, the old *M. leucadendron*, Linn., the only one which from Australia spreads itself over the Indian archipelago and the Malayan peninsula, is, with this very wide geographical range, also singularly polymorphous. It has been divided into more than a dozen species; and most botanists retain two, three, or four as distinct, the extreme forms being widely dissimilar; but the characters, derived chiefly from the shape and size of the leaves, from the dense or interrupted spikes, from the size and colour of the flower, and from the indumentum, are so variously combined in different specimens, the forms at other times pass so gradually one into the other, or differ so much at different ages, or even on different branches of the same tree, that I have completely failed in the endeavour to sort the specimens into distinct races.

The seeds, in the few species where they have been examined in the ripe state, differ considerably in shape, in the presence or absence of wings, and in the shape of the cotyledons of their embryo; but these differences, as far as known, do not appear to be available for the distinction of sectional groups.

LAMARCHEA, Gaud., and CONOTHAMNUS, Lindl., the former monotypic, the latter consisting of two species only, differ from *Me-*

laleuca by single characters only. *Lamarchea*, with the habit of several narrow-leaved large-flowered species, has the staminal bundles united in a single tube; *Conothamnus*, with opposite leaves, has the ovules solitary in each cell of the ovary, as in *Beaufortia*. These genera are only retained with a view to simplify the generic character of *Melaleuca*.

The subtribe of BEAUFORTIEÆ, differing from Euleptospermeæ in the erect anthers attached by the base, consists of the five Australian genera BEAUFORTIA, Br., REGELIA, Schau., PHYMATOCARPUS, F. Muell., CALOTHAMNUS, Labill., and EREMÆA, Lindl., all well characterized and generally admitted, and therefore calling for no special remarks beyond what are given in the 'Flora Australiensis.'

Under the subtribe EUCALYPTEÆ we have brought together the two Australian genera ANGOPHORA, Cav., and EUCALYPTUS, L'Hér., nearly allied to each other but perfectly distinct and never confounded with any other Myrtaceæ. The first, a small genus, has never been disputed since first separated from *Metrosideros*. The other, *Eucalyptus*, which constitutes so large and valuable a portion of the forest-vegetation of Australia, is at the same time the most numerous in species amongst capsular Myrtaceæ. Like all very natural genera, whilst it is readily defined as a whole, its division into sections and species is exceedingly difficult, and at present very unsatisfactory. The best characters which have been found are enumerated and discussed in the 'Flora Australiensis;' but a few words may here be added as to the genera proposed to be separated from it. These are two—*Eudesmia*, Br., and *Symphyomyrtus*, Schau. The former was distinguished by the prominent teeth of the calyx and the tetradelphous stamens; and if these characters had proved constant and tolerably well defined, the separation would have been fully justified according to the principles upon which other capsular genera were at that time distinguished. The claws, however, of the staminal bundles are in the original *Eudesmia tetragona*, Br., so broad and short as to be at best scarcely more than slight dilatations of the staminal disk; and in some specimens the tetradelphy is scarcely perceptible, and the teeth of the calyx are often not more prominent than in *Eucalyptus globulus* and some others; whilst in the species of *Eucalyptus* closely allied to *E. tetragona*, we have two (*E. erythrocorys*, F. Muell., and *E. eudesmioides*, F. Muell.) in which the tetradelphy is more prominent, but the calyx-teeth scarcely perceptible; in another, *E. odontocarpa*, F. Muell., the calyx-teeth are prominent

but the stamens not perceptibly clustered; and in the remaining species which on general grounds would belong to the same section, neither character is clearly appreciable. We have thought ourselves, therefore, compelled to follow F. Mueller in reducing *Eudesmia* to a section of *Eucalyptus*. *Symphyomyrtus*, Schau., has still weaker claims to maintenance. It was founded on *Eucalyptus Lehmanni*, Preiss, a species so closely allied to *E. cornuta*, Labill., that F. Mueller thinks it a variety only, but in which the calyces, instead of being closely sessile only, are more or less immersed in the enlarged and thickened receptacles—a character to which we can by no means give any more than a specific value.

Since the above notes were penned, I have received from Mr. Woolls, of Parramatta, in the 'Sydney Herald' of the 26th of Aug., 1867, a long and interesting article on *Eucalyptus*, in which he strongly objects to my arrangement as "placing in the same group species which, in the eyes of the colonists, are always regarded as perfectly distinct from each other, and also of separating, under various sections, trees which, by bark, wood, habit, and general character, ought to stand near each other." These are, it must be admitted, grave objections; and I should be most ready to adopt any more natural method by which local botanists, having the advantage of observing the species in a living state, may arrange the whole genus into groups marked out by tolerably definite characters. Mr. Woolls thinks that Dr. F. Mueller's cortical system is the best that has yet been devised; but as that has not yet been applied to one half of the genus, and, indeed, seems to be scarcely applicable to the low bushy species, and the characters on which it is founded are, in nine cases out of ten, not to be ascertained from museum specimens, or to be derived only from uncertain or contradictory collectors' notes, it is at present useless to botanists. We must therefore wait to judge of it till Dr. Mueller has worked it out in his promised monograph. In the meantime it must be admitted that this cortical system is probably excellent for the practical arrangement of the tree Eucalyptuses of limited localities. So also in the south of Europe would be the popular arrangement of Oaks into white Oaks, black Oaks, and cork Oaks (Chênes blancs, Chênes-verts, and Chênes-liéges, as they are there called); but botanists would hardly accept of it for the general subdivision of the whole genus *Quercus*.

With regard to the homology of the operculum of *Eucalyptus*, it is said, in the 'Flora Australiensis,' that the single (or, when it is double, the inner) one probably represents the petals,—which is ob-

jected to by F. Mueller, chiefly, I believe, on the ground of its perfect continuity with the calyx-tube in the bud of many species without any circular rim or apparent articulation; that, however, may be observed in the buds of *Angophora*, as well as of some species of *Darwinia* and other Chamælaucieæ, where the minute calyx-teeth leave a broad interval between them. The arguments adduced by Brown (App. Flind. Voy. ii. 600, Works, ed. Benn. i. 75) to show that in *Eudesmia* at least the operculum is formed of confluent petals only, and that in *E. globulus*, and other species where it is double, the outer one may be considered to be formed of the calyx and the inner one of petals alone, have been further confirmed by subsequent observations. The species, however, where the outer operculum exists at an early stage have proved to be much more numerous; and in *E. platyphylla* and *E. maculata* it is much thicker and more persistent than usual, marked often with prominent ribs corresponding with those of the calyx-tube. On the other hand the species where, notwithstanding its apparent homogeneity, the operculum is probably composed of both floral envelopes united, seem to me to be much fewer than was supposed by Brown. The only one where there may be corroborative evidence of the hypothesis is perhaps *E. erythrocorys*, where the exceedingly thick fleshy operculum is marked with four raised ribs corresponding to those of the calyx-tube, and between them are ribs and raised veins, which may be presumed to be those of the petals.

It is remarkable that a genus so extremely abundant, both in species and in individuals, throughout Australia, from the alpine regions of Tasmania and Victoria to the arid burning deserts of the northern coast, should scarcely have been detected beyond its limits. No *Eucalyptus* is known from New Zealand or from New Caledonia. Two only of the northern species have been also found in Timor; but beyond that we have no satisfactory evidence of any extension of the geographical range of the genus. Four species, indeed, are given in books as natives of the more distant islands of the Indian archipelago; but it does not appear that any native specimen undoubtedly referable to the genus exists in any of our herbaria. Of the four species referred to, the one that rests upon the best grounds is perhaps *E. moluccana*, Roxb., described in his 'Flora Indica,' ii. p. 498, from a tree in the Calcutta Garden, said to be a native of the Moluccas, but without any record as to when or by whom introduced, and I cannot find that any specimen or drawing has been preserved. Miquel refers it to *E. alba*, Reinw., a native of North Australia and

Timor; but that is mere guesswork, and Roxburgh's short description is quite at variance with that species. Blume, in his 'Museum Botanicum,' i. p. 83, adds three species:—*E. deglupta*, described from a Celebes specimen in leaf only, which he found in Reinwardt's collection under the doubtful name of *Populus*? *deglubata*; *E. versicolor*, from the Moluccas, taken up from Rumphius's description and rude figure of *Arbor versicolor Ay-alla* (Herb. Amb. iii. p. 122, t. 80, not t. 53, which is an *Eugenia*) without flowers or fruit; and *E. sarassa*, Blume, founded on Rumphius's incidental mention of the *Sarassa*-tree in the same article, all three species conjecturally referred by Blume to *Eucalyptus* on account of their resinous bark, described as detaching itself in patches. A fifth species from a still more distant region, Mindanao, one of the Philippine islands, is described by A. Gray in the 'Botany of the American Exploring Expedition,' p. 554, under the name of *E. multiflora*, Rich., from a specimen in leaf, and with a panicle of old fruits from which the calyx-limb and operculum, if any, are fallen away, and the open capsules have lost all their seeds. The 4-celled (not 3-celled) capsule is the only character leading us to suppose that it may be a *Eucalyptus* rather than a *Tristania* or a *Metrosideros*. No mention of it occurs in Blanco's 'Flora.'

The METROSIDEREÆ, forming the last subtribe of Leptospermeæ, scarcely differ from Euleptospermeæ in their floral or carpological characters, but form a not unnatural group, chiefly distinguished by their inflorescence and foliage, which connect them with Myrteæ, almost passing, indeed, into that tribe through *Backhousia* and *Osbornia*. One or two species of *Metrosideros* and perhaps of *Tristania* have something of the aspect of *Eucalyptus*, but not the inflorescence; nor do any of the subtribe ever show the closely sessile flowers of Euleptospermeæ. If, again, some of the smaller-leaved Metrosidereæ may occasionally approach in habit a few of the larger-leaved Bæckeeæ, the stamens, and especially the embryo, will always supply good distinctive characters. The Metrosidereæ contain also a larger proportion of extra-Australian species than any other subtribe of capsular Myrtaceæ.

The proper division of the tribe into genera and subgenera is not easy to determine upon—not so much from the want of tangible characters, as in Myrteæ, but from the number of monotypic or almost monotypic forms, which leave it doubtful and in some measure an arbitrary matter whether they should be considered specific, sectional, or generic. We have, in our 'Genera Plantarum,' admitted eleven genera; but the number might, with almost equal

propriety, be raised to fifteen, or, perhaps still better, reduced to six.

Acicalyptus, A. Gray, was established for a species from the Fiji Islands, to which afterwards a second was added from the same locality, both of very doubtful affinity, being only known from specimens in flower and bud. A. Gray, from the appearance of the ovary, suspected that the fruit was capsular, and on that supposition indicated the affinity to *Eucalyptus* in its 4-merous flowers and circumsciss operculum. This operculum, however, is in both species evidently formed of the calyx alone, with the free petals inside as in *Calyptranthes*, not of the corolla alone or combined with the calyx as in *Eucalyptus*; and we therefore, in the 'Genera Plantarum,' acting still on the supposition that the fruit was probably capsular, placed it at the commencement of Metrosidereæ instead of among Eucalypteæ. Since then Seemann has discovered, amongst his Eugenias from the same islands, what he presumes to be a third species, in which he finds the fruit to be baccate; and he therefore reduces the whole to *Calyptranthes*. In this he may be right; but at present it can but be the result of pure conjecture, the seed being unknown or at least unexamined; the appearance of the ovary and the 4-merous flowers, as well as the geographical station, are against the union. The habit and the arrangement of the petals in the third species (*Calyptranthes eugenioides*, Seem.) are also much more those of *Eugenia*, sect. *Syzygium*, than of *Calyptranthes*. Our specimen has no fruit, so that we can determine nothing; but should the seed prove, as is probable, to have the *Eugenia* embryo, then A. Gray's genus *Acicalyptus* will stand under that name or be reduced to *Cleistocalyx* of Blume, but must be transferred to Myrteæ, next to *Eugenia*.

Tristania, R. Br., with the 5-adelphous stamens of *Melaleuca*, has the habit, inflorescence, and other characters of Metrosidereæ. It differs from *Metrosideros* and its immediate allies, besides the stamens, in the ovules tending downwards instead of upwards, and usually in its alternate leaves. It comprises, however, three sections, having almost as strong claims to be considered distinct genera as the small genera more closely allied to *Metrosideros*, but which it appears more convenient to follow Brown in retaining under one generally adopted generic name. The most distinct is *Neriophyllum*, in which the leaves are opposite, the ovules are numerous and mostly horizontal, and the union of the stamens in bundles is less decided than in the other sections. It consists, however, but of a single Australian species, and no object

would be gained by its separation. The other two sections, with alternate leaves, have both been proposed as genera. The one, *Lophostemon*, Schott, characterized by the remarkably long staminal claws, has also the numerous ovules of *Neriophyllum*, and linear-cuneate, not flattened seeds. It contains three Australian species. The third section, which may be considered typical of the genus, has short staminal claws, few, pendulous ovules, and the seeds sometimes but not always winged. It contains 10 to 12 species ranging over Australia, New Caledonia, and the Indian archipelago, and includes *Tristaniopsis* of Brongniart and Gris. These distinguished botanists, whose observations on, and descriptions of, New-Caledonian plants are most careful and accurate, and whose opinions must carry great weight, insist, in a supplementary article (Ann. Sc. Nat. Par. ser. 5, vi. 264), on the maintenance of *Tristaniopsis*, relying chiefly on the above-mentioned differences in the ovules and seeds. In this instance, however, we must still think that the two groups are much more appropriately treated as sections than as genera. Although we know of no genus amongst Myrtaceæ which contains at once species with few ascending and others with few descending ovules, yet *Leptospermum* and *Kunzea* are examples of natural genera in which the ovules, as in *Tristania*, are in one section few and pendulous, and in another numerous, crowded, and mostly horizontal; so in *Melaleuca* they are in some species few and ascending, in others numerous, crowded, and horizontal; and in none of these cases, any more than in *Tristania*, do these characters mark groups which we should consider sufficiently natural to be raised to the rank of genera. The winged seeds of *Tristaniopsis* are not constant in the Australian species.

Then follow six genera with opposite leaves, free stamens, and the ovules erect or ascending, unless when very numerous and horizontal—genera which might perhaps with more propriety be reduced to sections of *Metrosideros*, had there been sufficient real advantage to compensate the disturbance of existing nomenclature. These are:—1. SYNCARPIA, Ten., two Australian species now characterized by the capitate inflorescence. It was originally founded by Tenore under the name of *Syncarpia*, and nearly at the same time by Nees under that of *Kamptzia*, for the old *Metrosideros glomerata*, Sm., in which the calyces are connate and the ovules very numerous; to this F. Mueller has since added his *S. leptopetala*, in which the flowers are free, though capitate, and the ovules solitary in each cell, and erect, which characters, with

some minor ones, might have constituted quite as good a monotypic genus as any of those separated from *Metrosideros*. 2. LYSICARPUS, F. Muell., another single Australian species, the *Tristania angustifolia*, Hook., referred to the latter genus on account of the stamens being slightly interrupted opposite to the sepals, and thus showing an approach to the section *Neriophyllum* of *Tristania*, but really much nearer to *Metrosideros*, differing in habit and in the polygamous flowers, the outer stamens of the hermaphrodite ones bearing moreover abortive reniform anthers. 3. CLOEZIA, Brongn. and Gris, to which are probably referable *Mooria* and *Ballardia* of Montrouzier, and comprising several New-Caledonian species, only differing from *Metrosideros* in the shorter stamens, fewer ovules, and more basal placentation. 4. TEPUALIA, Griseb., a single Chilian species, removed from *Metrosideros* on account of its habit, inflorescence, and geographical station, with the few ovules and basal placentation of the preceding genera. 5. SPERMOLEPIS, Brongn. and Gris, comprising two New Caledonian species unknown to me. Besides the 4-merous not 5-merous flowers, the seeds are described as solitary by abortion, bearing near the hilum a kind of involucre or ring of six membranous scales—a most remarkable anomaly, unless it should prove that these scales are abortive ovules adhering to the perfect seed. 6. NANIA, Miq., comprising one Malayan and one Australian species, which we have restored to *Metrosideros* as a section, as being more generally known under that genus, and scarcely differing, except in the broad flat, not linear-cuneate seed.

METROSIDEROS, Banks, was long the repository for all capsular Myrtaceæ with numerous free exserted stamens, and as now limited, besides the two *Naniæ* and a rather anomalous species from South Africa, contains a considerable number of forms ranging over the Pacific, from New Zealand and New Caledonia to the Sandwich Islands, some of them very variable in foliage and indumentum, and exceedingly difficult to distribute into well-defined species. All are distinguished from the neighbouring genera, chiefly by the numerous ovules covering the whole surface of the peltate or laterally adnate placenta. Some of the species differ considerably from each other in the ovary, wholly inferior or more or less of the upper portion free, sometimes after flowering remaining adnate only by the broad base.

XANTHOSTEMON, F. Muell., was first proposed for a North-Australian tree or shrub, remarkable for its long, erect, somewhat rigid stamens, with peculiar anthers, and differing also from

Metrosideros in its alternate leaves. To this he afterwards added the opposite-leaved species, which proves to be a congener of Miquel's *Nania*. Finding more recently that the character common to these two would also apply to the typical *Metrosideros*, he, in describing an additional alternate-leaved species, reunited the whole with the latter genus. In the meantime Brongniart and Gris, in describing New-Caledonian Myrtaceæ, had established their genus *Fremya*, which must include the two genuine species of alternate-leaved Xanthostemons. In retaining the genus the laws of priority compel us to adopt F. Mueller's name, but with the much more definite characters given by Brongniart and Gris, the most important of which, besides the habit, is the insertion of the ovules in a ring round the margin or base of a peltate or clavate placenta. *Draparnaudia* of Montrouzier is probably a species of the same genus.

Backhousia, Harv. & Hook., with four species, and Osbornia, F. Muell., with a single species, all Australian, are placed at the end of the tribe, as connecting it with Myrteæ; for the fruit, apparently dry and hard as in Leptospermeæ, is indehiscent as in Myrteæ, or separates into indehiscent cocci. As genera they are both of them very distinct by a variety of characters.

Tribe III. Myrteæ.

This vast tribe, with uniformly opposite dotted leaves, and characterized by the succulent indehiscent fruit, is, with very few exceptions, limited to tropical or subtropical regions, extending over both the new and the old world. With almost a few exceptions, there is so little definiteness in the floral or carpological differences exhibited by their numerous species, that their distribution into genera is exceedingly difficult, and has become to a great extent arbitrary. After deducting a few monotypic or very small genera presenting more positive abnormal though perhaps artificial characters, the whole of the twelve or thirteen hundred species now known might be almost equally well united into a single genus *Myrtus*, or distributed into the four old genera *Psidium*, *Calyptranthes*, *Myrtus*, and *Eugenia*, as dispersed in the 60 or 70 genera proposed by Blume, O. Berg, and others, or reduced to 18 to 20 as in our 'Genera Plantarum.' In thus rejecting so large a proportion, especially of the South-American genera proposed by Berg, it is not that we do not appreciate his zealous labours in wading through the chaos presented by the innumerable forms preserved in herbaria, nor that we deny that

the great genera we have adopted may yet be satisfactorily divided into subordinate groups, but we think that in this process he has not met with more success than his predecessors. In attempting to determine species by his work it has appeared to me that the divisions he proposes are not natural enough to enable us to sort the specimens approximatively without examination; and at the same time, if taken as artificial sections, their characters (beyond the embryo, which is so rarely to be met with) are too vague and undefined to serve for practical purposes. We think therefore that the classification of the South-American species of *Campomanesia*, *Psidium*, *Myrtus*, *Myrcia*, *Marlieria*, *Calyptranthes*, and *Eugenia* is a labour to be entirely recommenced when a botanist shall be found courageous enough to undertake so tedious a task.

The first genus we have adopted, Feijoa, Berg (first described by him under the name of *Orthostemon*, which proved to be preoccupied by a Gentianous genus of Brown's), is a single Brazilian species, with something of the aspect of *Psidium*, but remarkable for its thickish filaments, all, or at least the outer ones, erect in the bud. That character alone would not, indeed, be necessarily more than specific; for we know that in *Eucalyptus*, for instance, although it distinguishes *Cornutæ* as a section, it is specific only in *E. marginata* and not even that in *E. tereticornis* and *E. Oldfieldii*. In *Feijoa*, however, the seed, according to Berg, has the embryo imbedded in albumen, which, as far as hitherto known, is absolutely exceptional in the Order. Berg has therefore proposed it as a distinct subtribe of Myrteæ. We know, however, that in Leguminosæ, Rosaceæ, and other typically exalbuminous orders the occasional presence of albumen is no more than generic, and even then often separates species which are otherwise very closely allied. Our specimens of *Feijoa* have no ripe fruit, and Berg does not figure the seed, so that we do not know what is the proportion of albumen present, nor can we conclude that it is always absent in the nearest allied genera until the seeds of more of the species shall have been observed; we have therefore retained *Feijoa*, but as a genus only.

Campomanesia, Ruiz and Pav., was originally distinguished by the authors from *Psidium* by the few large seeds arranged in a single series round the central fleshy axis, to which Kunth added that of the increased number of cells to the ovary. De Candolle, having no specimens, had no means of verifying these characters, which have broken down when applied to the numerous species now known. Berg has supplied several others, which, although

none of them appear to be absolute, may yet, taken together, be allowed to separate two groups which we retain as the genera *Campomanesia* and *Psidium*, each with about 100 species, according to Berg's views (probably reducible by one half), distributed by him, the one into five, the other into three genera. The first of these characters brought forward by Berg, the embryo "spiralis, 2–3-cyclicus" in the *Campomanesia* group, only "uncinato-curvatus, subspiralis v. semiannularis" in *Psidium* and adjoining genera, is, perhaps, the least to be relied on. Independently of the numerous species where the embryo is unknown, if we look at the seeds figured by Berg in the 'Flora Brasiliensis,' t. 53 (*Britoa*) and t. 42 (*Psidium*), we should surely call the embryo in both uncinato-curvatus, and certainly not 2–3-cyclicus in the *Britoa* as it ought to be; and other equally contradictory instances occur in species not figured. It is probable, however, that in most species the seeds have a thinner testa and a longer radicle in proportion to the cotyledons in *Campomanesia* than in *Psidium*; the calyx-limb is less frequently produced below the lobes so as to split in enlarging; the ovary-cells are usually, but not always, 6 or more in the former, only 4 or 5 in the latter; and the most constant distinction given by Berg, as far as I have had occasion to verify it, is the arrangement of the ovules in 2 rows (or very rarely in 4) in each cell, whilst in *Psidium* they are more irregularly crowded. The species of *Campomanesia* are all American.

We propose reuniting with *Campomanesia* four of Berg's genera:—1. *Abbevillea* contains several species, correctly separated from *Psidium* on account of the arrangement of the ovules and the structure of the seeds (where known) agreeing with *Campomanesia*, from which he only appears to distinguish it by the calyx-limb, more or less developed below the lobes; but in this respect I cannot trace the difference between several species of *Abbevillea* (e. g. *A. Guaviroba*, Berg) and others of *Campomanesia* (e. g. *C. lineatifolia*, Berg). 2. *Acrandra*, which has the connectivum of the anthers produced into a very short point—a single character unaccompanied by any other difference in habit or structure. 3. *Britoa*, with an ample calyx-limb almost closed, with very small lobes in the bud, but afterwards splitting as in the majority of *Psidia*; but this character, though generally good, affords too many gradations in *Psidium* itself to be taken as generic when unaccompanied by any other. 4. *Lacerdæa*, at first distinguished from *Britoa* and *Campomanesia* by the calyx-lobes free from the base as in the latter genus but coriaceous as in the former. The

author, however, subsequently (Linnæa, xxx. 713) acknowledged that *Lacerdæa* was not really distinct from *Britoa*.

Paivæa, Berg, is founded on a single Brazilian species, with the habit and general character, as far as known, of *Campomanesia*, but with the calyx-limb remarkably dilated at the base into five protuberances, very prominent in the bud. It is doubtful whether this peculiarity is of any more than specific value; but as the ripe fruit and seed are as yet unknown, and as the ovary requires further investigation in more advanced specimens, we have retained the genus until its real place shall be ascertained by the examination of the embryo.

Psidium, Linn., a large American genus, of which one or two species have been long in cultivation in most tropical regions under the name of *Guava*, has been generally distinguished from *Myrtus* and *Eugenia* by the valvate calyx, the 4- or 5-celled ovary, and numerous small seeds. The first character, however, which is still the principal one to separate it from *Myrtus*, is to a certain degree a mistake; the real calyx-lobes, when developed, are, as in all other Myrteæ, imbricate in the bud; but they are very small or even entirely abortive, and the undivided part of the limb, closed over the petals and stamens in the bud, instead of dilating as the flower opens as in *Myrtus* and *Eugenia*, or becoming circumsciss round the base as in *Calyptranthes* and *Acicalyptus*, splits longitudinally or bursts irregularly and remains persistent, the parts having but rarely any regular relation to the number of sepals. The 4- or 5-celled ovary is also a general character, but not quite constant, a few species having the number reduced to 2 or 3, as in *Myrtus*; the number and size of the seeds is much more variable than at first supposed. The embryo is that of *Myrtus*, the habit somewhat different. The distinction from *Campomanesia* has been already noticed.

We propose reuniting with *Psidium* two of Berg's genera:—1. *Acca*, a single Peruvian species (the two established by Berg, chiefly on geographical grounds, prove to have both the same origin), was indicated by DeCandolle as a genus distinct from *Eugenia*, under which it had been published; but I can discover nothing in habit or character to separate it from *Psidium*. 2. *Calyptropsidium* is a Guatemalan species, which is unknown to us, except from Berg's description. By this it appears only to differ from *Psidium* in that the calyx-limb, besides splitting longitudinally, is at length more or less circumsciss at the base.

Psidiopsis, Berg, and Calycolpus, Berg, are two small genera,

the first monotypic, the second of very few species, connecting, as it were, *Psidium* with *Myrtus*, but retained in order the better to draw the line between those large genera. Both have usually the 4- or 5-celled ovary and the ovules of *Psidium*, but the bud is crowned with large leafy calyx-lobes; in *Psidiopsis* the calyx-limb splits below these lobes as in *Psidium*; in *Calycolpus* it is either not developed below the lobes or is very short and expands without splitting as in *Myrtus*; and in one species, *C. calophyllus*, Berg, these lobes are scarcely foliaceous. The embryo is unknown in *Psidiopsis*; in *Calycolpus* it is like that of *Psidium* and *Myrtus*. The habit of both is nearly that of *Psidium*, although in *Calycolpus* it may sometimes be thought to come nearer to that of the section *Ugni* of *Myrtus*.

Rhodomyrtus, DC., was originally proposed, as either a section of *Myrtus* or a distinct genus, for the pink-flowered *M. tomentosa*, remarkable for its triplinerved leaves like those of Malastomaceæ. This, however, which was believed to be the principal character, was ultimately not thought by DeCandolle to be of higher than sectional value, notwithstanding some differences observed in the arrangement of the ovules and the supposed increased number of cells. But the recent addition of four Australian species, and a careful study of the ovary and fruit, have since pointed out other characters which, together with the habit, nearer to that of *Psidium* than of *Myrtus*, have induced us to adopt *Rhodomyrtus* as a genus. The venation of the leaves has not proved constant; for of the five species two only are triplinerved, one is penninerved, and the remaining two show an intramarginal vein, more or less incomplete or perfect, so as to form the passage from the one to the other. The ovary is, as in *Myrtus*, 2- or 3-carpellary, or in one species reduced to a single carpel; but the ovules are superposed in two long rows in each carpel, with a longitudinal spurious septum between the rows, so as, on a transverse section, to give the appearance of twice as many cells as carpels; besides which, spurious transverse septa, like those of *Timonius* (or *Nelitris*, Gærtn.) in Rubiaceæ, separate each seed—a circumstance not hitherto observed in any other Myrtacea, its having been indicated in *Decaspermum* (*Nelitris*, Lindl.) being, as I shall presently have to point out, erroneous.

The typical genus Myrtus is the one to which it is perhaps the most difficult to assign its proper limits. Originally distinguished from *Eugenia* by the fruit, evidently 2- or 3-celled, instead of apparently 1-celled (the structure of the ovary being

at that time disregarded), it was, after the reformation of the tribe founded on embryonic characters, limited by DeCandolle to the species with few seeds, a bony testa, and horseshoe embryo, always supposed to be accompanied by 5-merous flowers; and numerous 4-merous, especially Chilian, species, of which the seed was unknown, were transferred to *Eugenia*. The greater number of these, however, have since proved to have the seed and embryo of *Myrtus*, or nearly so, and have either been restored as sections of *Myrtus*, or raised into distinct but closely allied genera, thus forming a group, distinguished from *Campomanesia* and *Psidium* by the ovary never more than 3-celled, and from the latter by the form of the embryo-limb and generally by the habit, from *Myrcia*, *Marlieria*, and *Calyptranthes* by the ovules always more than two in each cell, from *Eugenia* by the embryo only as a positive character, with occasional collateral aids from inflorescence and habit, and from various smaller genera by the absence of the exceptional characters which have severally induced their separation. It is the group thus (perhaps still somewhat vaguely) limited that we have adopted as the genus *Myrtus*, reducing to sections some tolerably distinct subordinate groups established by A. Gray and others. If I observe that the generic limits are still somewhat uncertain, it is because the number of cells of the ovary, although perhaps never more than three in *Myrtus*, except in a few abnormally exceptional flowers, is nevertheless sometimes, although rarely, reduced to two or three in *Psidium*; and the embryo in a very few species has so thick and little curved a radicle, and the cotyledons so very small, that it may be mistaken for the apparently homogeneous embryo of *Eugenia*, not to speak of the numerous species of which the embryo is as yet unknown.

Eight or nine genera have been proposed to be dismembered from the American *Myrti*, some of which form excellent sections, which we might even have adopted as genera, had it not been for some Australian, and even a few American, species, which tend to invalidate their artificial characters, whilst there is little or nothing to render them really natural divisions. These are:—

1. *Ugni*, proposed by Turczaninow for those Chilian and Andine species which, on account of their 4-merous flowers (the embryo being then unknown), had been referred by DeCandolle to *Eugenia*. They have, moreover, the calyx-lobes spreading in the bud, and the erect anthers of *Calycolpus* and other Psidioid genera. This is thus the most distinct of all the subordinate groups, and we hesitated much whether we should not admit it as a substantive genus;

but the habit, the 1-flowered peduncles, the ovary, and the seeds are so decidedly those of the typical European *Myrtus*, that we have followed A. Gray in reuniting it as a section.

2. *Eumyrtus*, or the genus *Myrtus* as limited by Berg. Besides our own European Myrtle, this includes a considerable number of extratropical and Andine South-American species; they are all 5-merous, the peduncles are 1-flowered, or very rarely 3-flowered, the anthers are versatile, and the seeds, as far as known, have always a hard testa, a long curved but not spirally rolled embryo, with very small colytedons.

3. *Leantria*, a sectional name taken up by A. Gray from a proposed generic name of Solander's quoted by Forster, is the group established by Berg as his genus *Myrteola*. It contains about ten species from Andine and extratropical South America, which have either the habit of *Eumyrtus* or are smaller and more prostrate, and have also its characters, except that the dissepiment of the ovary is incomplete, not reaching the top of the cavity.

4. *Luma* was proposed by A. Gray as a genus under that name, and by Berg under that of *Myrceeugenia*, for several species, chiefly Andine or Chilian, which, like the *Ugnis*, had, whilst their seeds were unknown, been referred to *Eugenia* on account of their 4-merous flowers. They have nearly the habit of *Eumyrtus*, but have frequently three to seven flowers on the peduncles; and the seeds show more or less of an approximation to those of *Myrcia*; the testa is thin; and the colytedons, larger in proportion to the radicle than in *Eumyrtus* and *Ugni*, vary from one species to another, narrow or broad, long or short, flat or more or less folded. It was, on observing this great diversity from species to species, and the combination of the thin testa and small cotyledons in *Temu* and *Blepharocalyx* of Berg, that we were prevented from following A. Gray in adopting the genus *Luma*, which, as a section, rests solely on the texture of the testa; and that character even is invalidated by at least one Australian species.

The following South-American Myrtoid groups had not come under A. Gray's observation:—1. *Temu*, Berg, a genus proposed for one or two Chilian species, with the flowers and thin testa of *Luma*, but with the small cotyledons of *Eumyrtus*, thus closely connecting the two sections. 2. *Anamomis*, Griseb., established on three West-Indian species, which appear to me, in every respect, to come within the section *Luma*, with which it did not occur to Grisebach to compare them. 3. *Blepharocalyx*, Berg,

a few South-American, chiefly Brazilian species, which, like *Temu*, have the flowers and thin testa of *Luma*, but differ slightly in the deciduous calyx-lobes.

4. *Pseudocaryophyllus*, Berg, containing several South-American species (including some of Kunth's *Myrti*), which, on account of their larger, more coriaceous leaves, and tetramerous flowers, have been referred by recent authors to *Eugenia*; some of them, of which he had not seen the fruit, are even still placed there by Berg. They prove, however, to have the ovary and seeds of *Myrtus*, but differ from all the above-mentioned sections in their numerous flowers in trichotomous cymes.

5. *Myrcianthes*, Berg, is made up of four species, of which two have furnished the generic character—*M. cisplatensis*, Berg (*Eugenia*, Camb.), and *M. apiculata*, Berg. These appear to me to be truly referable to the section *Luma*. Berg characterizes them chiefly by the embryo with thick plano-convex cotyledons, an exserted radicle, and a well-developed plumula enclosed between the cotyledons—that is, nearly the embryo of *Eugenia*, except that in that genus the radicle, when elongated, is turned in against or between the cotyledons; and the development of the plumula is so anomalous in the order, that one would be unwilling to admit it without repeated verification. The habit also is entirely that of the several-flowered *Myrti*, and very different from that of *Eugenia*. Unfortunately our specimens of all the species are in flower only, and we have no seed to examine; but, judging from the figure in the 'Flora Brasiliensis,' t. 32, we should conjecture that the so-called cotyledons may possibly be a very thick radicle folded on itself, such as we have found it in some of the *Blepharocalyx* group, and such as is described by Lindley, in Paxt. Fl. Gard. iii. 149, in *Eugenia apiculata*, DC., a true *Luma*, and that the supposed plumula consists merely of the small inflected cotyledons. Of the two remaining species, *M. brunnea*, Berg, of which the fruit is unknown, is probably a *Myrtus*; *M. edulis*, Berg, of which the plumula is not mentioned, may be a *Eugenia*.

Of the nine Australian species of *Myrtus* four have the 5-merous flowers, hard testa, and small cotyledons of *Eumyrtus*; but in three of them the embryo is very much longer and spirally involute, as in the *Campomanesia* group; two, also 5-merous, have the small cotyledons of *Eumyrtus*, the spirally involute embryo of *Campomanesia*, but with a testa approaching more nearly to that of *Luma*, being of a rather thin consistence and remarkably granular rugose, and one of them has the dissepiment incomplete as in

Leantria. In the three remaining species, two of them 5-merous and the third 4-merous, the seed is unknown.

It is on account of the above complications, the want of correspondence between the number of parts of the floral envelopes, the consistence of the testa, the comparative size and shape of the cotyledons and radicle, and the degree of development of the inflorescence, that we have proposed to include the whole of the above group in one genus, *Myrtus*. It is probable that when the seeds of most of the doubtful species shall become known, five or six tolerably well-marked American sections may be formed, including *Pseudocaryophyllus*, and perhaps *Blepharocalyx*, referring *Temu*, *Anamomis*, and *Myrcianthes* to *Luma*, and placing the Australian ones in two or three separate sections.

There remains the genus *Macropsidium* of Blume, unknown to us, but referred by Miquel to *Psidium*, and which in the 'Genera' we thought showed all the characters of *Myrtus*. In either case the geographical station, the island of Gilolo in the Moluccas, would be quite exceptional. On restudying Blume's character, it has occurred to me that the 4-celled ovary, with numerous uniseriate ovules, may be in fact a 2-celled ovary divided by longitudinal spurious dissepiments, in which case the plant would be referable to *Rhodomyrtus*, a genus already known in the archipelago. Blume's second species is conjectural only, founded on Loureiro's description of his *Psidium rubrum*.

Rhodamnia, Jack (with which *Monoxora*, Wight, has proved to be identical), is one of the most distinct genera amongst Eumyrteæ, and, as far as hitherto known, presents no ambiguity. There are about a dozen species, from tropical Asia and Australia, with the three-nerved or triplinerved leaves (which are, besides, only known in Myrtaceæ in a few species of *Rhodomyrtus*), the inflorescence and 4-merous flowers of the typical American Eugenias, and the seeds and embryo of *Myrtus*, but which are absolutely exceptional in Eumyrteæ by their ovary 1-celled, with two parietal placenta, without any trace of dissepiment.

Fenzlia, Endl., is also exceptional, but is almost monotypic, consisting only of two tropical or subtropical Australian species, closely allied to each other. The ovary is reduced to two or to a single carpel, as in some species of *Rhodomyrtus*; and the ovules, very few in number, are superposed, as in that genus, but in a single row. The habit and inflorescence show an approach to *Osbornia* in Leptospermeæ; the fruit, a 1- or 2-seeded drupe, with a bony endocarp and thin almost dry exocarp, is also very near

to what is believed to be that of *Osbornia*. The seed and embryo are nearly those of some Australian *Myrti*, the testa thin, the radicle very long and much coiled round the linear cotyledons.

Decaspermum, Forst., is the name which ought to have been adopted for the small genus which stands in our 'Genera Plantarum' as *Nelitris*, Gærtn. In this we had followed Lindley, De Candolle, and other modern botanists, not suspecting that their identification of Gærtner's genus was erroneous. We had, unfortunately, overlooked the fact that Thwaites (Enum. Pl. Zeyl. 153) had ascertained that Gærtner's plant belongs to the Rubiaceous genus now known under the name of *Timonius*, Rumph. A careful study of Gærtner's description of the fruit would, indeed, have shown that it could not be that of *Decaspermum*; but what probably originally led to the error is, that he expressly describes the seed as exalbuminous, and it was not until A. Gray's careful review of the Guettardeæ that it was observed that the albumen was wanting in *Timonius*, or, indeed, that it was supposed that it ever was deficient in any Rubiacea. For the Myrtaceous genus we must therefore have recourse to Forster's name, although far from appropriate. It consists of very few species, from eastern tropical Asia and tropical Australia, nearly allied to *Myrtus*. They have the hard testa and the embryo of the section *Eumyrtus*; but the inflorescence is racemose, as in some American *Eugeniæ*, never cymose as in the many-flowered *Myrti*; the ovary is 4- or 5-celled, whilst it is only 2- or 3-celled in *Myrtus*; and the ovules, 2 or 3 in each cell, or very rarely more, show an approach rather to *Myrcia* than to *Myrtus*.

Myrcia, DC., is a very large tropical and subtropical American genus, allied to *Myrtus*, but originally separated on account of the embryo, which, in the few seeds then known, showed large broad cotyledons, more or less folded. Now that many more seeds have been examined this character proves to be not near so constant as had been supposed; the embryo often varies from species to species, and in some of the section *Luma* of *Myrtus* it is very much like that of some species of *Myrcia*; and it is probable that if the seeds of all were known the connexion would be found still closer. The genus may, however, be retained; for, besides the inflorescence, which is usually more compound, there appears to be a more constant difference, in the ovary containing only 2 collateral ovules in each cell. The cells are usually 2, or rarely 3, and the flowers almost always 5-merous, as in the section *Eumyrtus*. The 500 supposed species of *Myrcia* may probably

be reduced to 300; but this is still a very large number, rendering the task of grouping exceedingly difficult when there is so very little in their characters of absolute difference definable in words. Berg has, indeed, proposed to separate five genera upon modifications of the calyx-limb and anthers; but in going through a considerable number of species, these differences have frequently appeared to us so difficult to appreciate, and so little in accordance with habit, that we cannot but agree with Grisebach in reuniting them all with *Myrcia*. The division of this overgrown genus into good sections must be the work of renewed and patient investigation. The Bergian genera are:—

1. *Myrcia*, which he limits to 188 species, with the stamens inserted immediately round the margin of the ovary, without any development of the calyx-limb below them.

2. *Aulomyrcia*, of which he enumerates 251 species, distinguished by the calyx-tube being more or less evidently produced between the margin of the ovary and the insertion of the stamens. This character is sometimes very prominent; but in other cases it is very difficult to say whether the interval is perceptible or not. Its uncertainty will indeed be manifest by a glance at Berg's analysis of *Aulomyrcia obovata*, Berg, Fl. Bras. Myrt. t. 19, which is said to have "Hypanthium supra germen valde productum," and of *Myrceeugenia myrtoides*, Berg, *l. c.* t. 25, which ought to have "Hypanthium supra germen haud productum."

3. *Calyptromyrcia*, 9 species, with the calyx-tube produced below the stamens, as in *Aulomyrcia*, but the limb less deeply divided above them, showing an approach to *Marlieria*. The outermost petal is also much larger than the others; but this irregularity occurs also in other *Myrciæ*.

4. *Gomidezia*, 48 species, with the calyx of *Aulomyrcia*, but with larger anthers, the cells opening by a shorter and more oblique slit, and one of them often placed higher up than the other.

5. *Cerquieria*, a single species, very much like several *Gomidezia* of Berg's group of *Magnifoliæ*, but in which the anthers are said to be 4-celled, opening in as many terminal pores. This, however, seems to be a delusion, arising from the anthers having opened already in the bud, and the margins of the slits being closely involute, so as apparently to divide the cells. It must be recollected also that, in the majority of Myrtaceæ as in other plants with so-called 2-celled anthers, each cell before opening is more or less completely divided by a longitudinal septum opposite to the line of dehiscence.

6. *Calycampe*, 2 Guiana species, only differing from *Myrcia* proper in the calyx-lobes being separated by broader sinuses.

MARLIERIA, Camb., is another American tropical and subtropical genus, with the biovulate ovary-cells and inflorescence of *Myrcia* and *Calyptranthes*, but with the calyx-limb quite closed over the petals in the bud, or only with minute lobes at the tops, and splitting valvately as the flower opens, as in *Psidium*. Berg enumerates 57 species (probably reducible to about 30), which he distributes in three genera, *Marlieria*, *Rubachia*, and *Eugeniopsis*, according to whether the calyx-limb is quite closed in the bud or shows 4 or 5 very small imbricate lobes. The petals are sometimes reduced or wanting as in *Calyptranthes*.

CALYPTRANTHES, Swartz, like *Marlieria*, has the ovary and seed of *Myrcia*, but is distinguished by the calyx; its limb is entire and closed over the petals in the bud as in *Marlieria*, but, instead of splitting longitudinally as the flower opens, it falls off in a single operculum, circumsciss at the base. The petals also, as in several *Marlieriæ*, are reduced to a very small size, or altogether wanting. Berg enumerates 73 species, all from tropical America. Among them we have temporarily included *Mitranthes*, Berg, a small group (8 species, according to Berg) differing from the typical *Calyptranthes* in their more numerous ovules. The ripe seed is unknown. Berg conjectures it to be that of *Eugenia*; the immature one which I was able to examine in *M. Gardneriana*, Berg, seemed to me to be rather that of the *Myrtus* group. Should this prove to be really the case, *Mitranthes* would, we think, most conveniently rank as a section of *Calyptranthes*. If, on the other hand, it has the embryo of *Eugenia*, we should probably, notwithstanding the difference of country, have to regard it, with *Acicalyptus*, as a section of *Eugenia*, or as an adjoining genus.

PIMENTA, Lindl., consists of very few species (5 according to Berg), from tropical America, one of them much cultivated in various tropical countries under the name of *Pimento* or *Allspice*, whence the generic name, although very different from the plants so generally known on the continent of Europe under the name *Piment*, which are all species or varieties of *Capsicum*. The Myrtaceous *Pimenta* has the habit, inflorescence, and embryo of the *Pseudocaryophyllus* group of *Myrtus*, but is very different in the structure of the ovary; the ovules, few in number (1 to 4 or perhaps, 6 in each cell) are attached to a placenta suspended from the apex of the cavity, whilst in all the great Myrtoid genera the placenta is adnate to the centre of the dissepiment or to the inner

angle of the cells. Berg proposes to limit the genus to the single *P. communis*, Lindl. (*P. officinalis*, Berg), which has 4-merous flowers and a spirally involute embryo of 2 or 3 coils, whilst the other species, which he separates under the name of *Amomis*, have 5-merous flowers and a much less involute embryo; but as we have not admitted these characters as sufficient in *Myrtus*, where the large number of species show their want of conformity with habit and other characters, so can we much less agree to their separating in this instance a single species without any difference in habit. We have found the embryo of *Pimenta acris* (*Amomis acris*, Berg) intermediate between that of *P. communis* and the other species of *Amomis* of Berg.

Myrrhinium, Schott, independently published also as *Feliciana* by Cambessèdes, and as *Tetrastemon* by Hooker, is a single species, widely spread in South America, which at first sight appeared so anomalous as to have been placed with some Melastomaceæ in the now abandoned order of Memecylæ. The stamens were supposed to be definite; but, although very few in number, they vary from four to eight; they are not in a single series, and are not placed in any regular position as to their alternation with sepals or petals, thus showing all the characteristics of indefinite stamens. The long straight filaments (which give them a peculiar aspect) are those of *Xanthostemon*, of *Feijoa*, or of *Eucalyptus cornuta* and its allies. *Myrrhinium* has also numerous ovules, placed on the margin of a bilamellate placenta, which is rare in the tribe, but occurs in a few species of *Myrtus*, and is moreover an arrangement strictly analogous to that of the ovules of *Bæckea* and *Xanthostemon*, which are inserted in a ring round the margin of a dilated placenta. The embryo of *Myrrhinium* is apparently homogeneous; so that it is as yet doubtful whether it consists of a radicle with minute or abortive cotyledons as in some species which we include in *Myrtus*, or whether the cotyledons are conferruminate as in *Eugenia*—a point that can only be settled by watching its germination.

Eugenia, Linn., is at once the largest and the widest-spread genus of the Order, and the one which has occasioned the greatest diversity of opinion as to its delimitation. Above 700 species are described, which a careful scrutiny might reduce to about 500; and whilst several eminent botanists, whose example we have followed, retain the genus in its integrity, others of equal ability have distributed the species into six or into ten genera, and others, again, have endeavoured to establish nineteen, besides two or three which we have adopted, but will perhaps ultimately be likewise

reduced to *Eugenia*. The species are most extensively distributed over tropical and subtropical America and Asia, with a much smaller number in tropical and subtropical Australia and Africa; and a very few of them are cultivated for their edible fruits or for their flower-buds used as spices.

The chief character connecting this vast group lies in the embryo, which is thick and fleshy, sometimes apparently homogeneous, but in most cases showing more or less distinctly two large thick cotyledons and an exceedingly short radicle. In other respects the embryo varies in shape, straight or somewhat curved; the two cotyledons are equal and hemispherical, or unequal and irregularly shaped, closely united or separable or quite distinct. The great difficulty, however, has been to find accompanying characters independent of the embryo, which is so seldom procurable, either in wild or cultivated specimens; for the 2-celled ovary with several ovules in each cell, the small stigma, and the stamens are quite those of *Myrtus*. The flowers of *Eugenia* are almost always 4-merous, and this was at one time thought to be a safe character to rely upon; but, as already observed, several South-American species, which on this account were transferred from *Myrtus* to *Eugenia*, had, when their embryo became known, to be restored to the former genus, of which, indeed, they have the habit. A very few species, moreover, of true *Eugeniæ* are exceptionally 5-merous; and in some, especially Asiatic ones, owing to the petal-like nature of the inner calyx-lobes, or to the abortion or consolidation of some or of all the petals, it is not easy to say what is their real number. Inflorescence, as pointed out by Grisebach, is an excellent indication for the majority of the American species. There are no secondary cymes in the *Eugeniæ* of that continent. When the flowers are clustered or paniculate in the axils it is from the contraction or development of leafless flowering branches ramified like the leafy ones; whilst in *Myrtus* and *Myrcia* the secondary cymose inflorescence, if not developed, is generally indicated by the opposite bracteoles under the calyx. But this collateral character fails entirely for the Asiatic species, the great majority of which have a trichotomous cymose inflorescence. Here, however, there is no practical difficulty, as there are no true *Myrti* known from tropical Asia. Australia has, like South America, several species of both genera, and like tropical Asia has both the inflorescences of *Eugenia*; but all the Australian *Eugeniæ* are 4-merous, and the *Myrti* 5-merous, except *M. fragrantissima*, F. Muell., which has every appearance of being a 4-merous *Myrtus*, but remains doubtful as the seed is unknown.

In the subdivision of this overgrown genus we have again followed Grisebach in attaching primary importance to inflorescence, although we cannot go so far as to give it generic value, which would necessitate the removal into *Jambosa* of nearly the whole of the Asiatic Eugenias, thus disturbing the nomenclature sanctioned by Wight, A. Gray, and others, without adequate advantage. There is no concomitant difference in the flowers or foliage; and after all, where the secondary inflorescence remains undeveloped (where the flowers are solitary in the axils) the character it supplies becomes almost theoretical, to be judged of chiefly by analogy or by geographical circumstances. We have in the next place adopted the distinction pointed out by De Candolle, the separate expansion of the petals in *Eugenia* proper and *Jambosa*, and their cohering and falling off together in *Syzygium*; but this distinction is far from being so absolute as was supposed when it was taken for the generic character of *Syzygium*, and requires supplementing by other considerations. In the *Jambosa* section the calyx-tube is rather more constantly produced between the ovary and the insertion of the stamens; and the limb above the stamens is distinctly divided into four usually persistent lobes; and the petals always expand and fall off separately. In *Syzygium* the interval between the ovary and the stamens is not always conspicuous, the calyx-limb is usually truncate or sinuate and obscurely lobed, or the lobes are deciduous, and the petals in most species are more or less coherent or very small, or altogether wanting. Where in either case one of the characters fails, it may be supplemented by the other. The habit presents in both groups nearly the same variations, which may serve for their further subdivision.

We shall thus have three great sections or subgenera:—*Jambosa* and *Syzygium*, each with about 60 (reduced from 80 or 90) Asiatic, Australian, and African species, and *Eugenia* proper (*Eueugenia*, Wight, or *Eugeniastrum*, Griseb.), with between 300 and 400 American species, with a few from Africa, Australia, and Asia. To these sections may, perhaps, be added a fourth, *Myrciaria*, to which I shall presently revert.

The genera which various authors have proposed to dismember from *Eugenia*, and which we would now, after Wight, Grisebach, and others restore to it, are, besides *Syzygium*, the following:—

Caryophyllus, Linn., was very naturally distinguished from *Eugenia* at a time when the few species of the latter genus then known had a short calyx-tube and free expanding petals; whilst

in *Caryophyllus* the long calyx-tube and coherent petals are particularly striking in the buds so well known as the cloves of commerce. And it is perhaps the great difference in the commercial use of the plant that has induced subsequent botanists to endeavour to keep up the genus, even since it has been ascertained how much the form of the calyx-tube varies from species to species. Thus DeCandolle and others have attempted to add a character derived from the stamens in the bud being arranged in four bundles, separated by the indented teeth of the calyx; but this is no more than the impression of the thickened midribs of the sepals, such as may be seen in the buds of other *Eugeniæ* with exceedingly numerous stamens, and disappears as the stamens expand. We therefore cannot but agree with Wight in annexing *Caryophyllus* to the section *Syzygium*, as we would restore to the section *Jambosa* the genera *Strongylocalyx*, Blume, *Clavimyrtus*, Blume, and *Macromyrtus*, Miq., all founded on the form of the calyx-tube, globular in the first, long and club-shaped in the second, still longer in the third.

Jambosa, DC., and *Microjambosa*, Blume, were separated, the former from *Eugenia* as then understood, the latter from *Syzygium*, and *Jambosa* is still kept up by Miquel, on account of the calyx-tube being in all three more or less produced between the ovary and the stamens; but this character has not appeared to us more definite or more conformable to habit in this case than in that of *Aulomyrcia*. In many species of the section *Jambosa* the ovary occupies, it is true, but a very small space in the bottom of the deep calyx-tube; but in others it reaches halfway up, or is so thickly fleshy at the top that it is difficult to say where it ends, and whether it does or not extend to the insertion of the stamens. The difficulty of appreciating this character may be readily seen by a glance at Blume's figures of *Strongylocalyx* and *Gelpkea* (Mus. Bot. t. 54 & 55), both referred by Miquel to the same genus, which ought to have the calyx-lobes divided to the ovary.

Acmena, DC., was founded upon what was supposed to be the *Metrosideros floribunda*, Sm., with a *Syzygium* calyx and fruit, but with 5 very small free petals; but, owing to the imperfect materials he possessed, and the deficiency of authentic specimens, DeCandolle had confounded three very different plants:—1. The true *Metrosideros floribunda* of Smith, with really 5-merous flowers, which has a capsular fruit, and is the *Angophora intermedia*, DC. 2. The plant figured by Ventenat as Smith's *M. floribunda*,

which is a true *Eugenia* of the section *Syzygium* (that is to say, it has the *Syzygium* inflorescence and calyx): this has usually 4 small petals, with the occasional addition of an inner series of still smaller ones; and I have always found them free, and separately deciduous; M. Mueller, however, who has published the species under the name of *Syzygium floribundum*, has observed them to be sometimes coherent: in reducing it, with other *Syzygia*, to *Eugenia*, I have not been able to keep up the specific name of *floribunda*, preoccupied in the larger genus, and I have entered it in the 'Flora Australiensis' under that of *E. Ventenatii*. 3. *Eugenia elliptica*, Sm., which is *Acmena floribunda* β. *elliptica*, DC., and is in every respect a *Syzygium* with the petals always united in a small flat calyptra. This species, with very much the habit of *E. Ventenatii*, is remarkable for its anthers with divaricate cells—a solitary exception, as far as hitherto observed, in the whole vast genus *Eugenia*, and which in this instance appears to have been overlooked by all botanists except F. Mueller. Here, again, I have been unable to keep up the original specific name, which was preoccupied, and have given it that of *E. Smithii*.

Strongylocalyx, Blume, founded on the shape of the calyx-tube, appears to me to belong to those species of the *Jambosa* section which DeCandolle had placed in *Eugenia* on account of the short broad adnate part of the tube; Miquel now places it in *Eugenia*, though it has the highly developed free part of the calyx-tube characteristic of his *Jambosa*. *Gelpkea*, Blume, is in this respect rather nearer *Eugenia* as understood by Miquel, but was characterized by Blume as having the calyx-lobes strictly valvate. I have seen no specimens; but from Blume's figure I feel convinced that there is here a misapprehension, like that of the same author in his character of *Leptospermum*, and that, although the æstivation is open when the bud is ready to expand, it is imbricate at an earlier stage, at any rate not valvate. Miquel, in referring the species to *Eugenia*, says that the calyx-lobes are separated by a broad sinus.

Eugenia alternifolia, Wight, Ic. t. 537, is remarkable as the only species known in the vast tribe of Eumyrteæ with alternate leaves. It was by some mistake that in the 'Genera Plantarum' we referred to it as a *Jambosa* with a calyptrate calyx: the operculum is formed of the petals; and the species is correctly ranked by Wight in the *Syzygium* section.

Turning now to the genera which we include in the section *Eueugenia*, *Plinia*, Linn., was founded upon the well-known *Eu-*

genia Michelii, Lam., and forms part of the genus *Stenocalyx* proposed by Berg on account of a peculiarity in the inflorescence. The peduncles, 1-flowered, as in *Eueugenia*, appear towards the base of axillary branches, and the lower subtending leaves are reduced to small bracts, the branch becoming leafy without flowers at the end; the inflorescence is thus an axillary raceme growing out into a leafy branch—a very vague character depending on the degree of development of the lower floral leaves. Berg adds to it that the calyx-lobes are longer and narrower than in *Eugenia*; but that only applies to a portion of the species. In *S. laxus*, Berg, and some others, they are broadly ovate. *Phyllocalyx*, Berg, is only distinguished from *Stenocalyx* by the still greater foliaceous expansion of the calyx-lobes. *Hexachlamys*, Berg, is a single species with hexamerous flowers; but we have seen that in many large genera of Myrtaceæ there are species with an exceptional increase or reduction in the number of parts, constant or occasional, without the circumstance being available for a generic character.

Jossinia, Comm., was established by DeCandolle for a few Mascarene species, which he compared to *Myrtus*, believing, from the numerous ovules, that they had probably the seeds of that genus but with the 4-merous flowers of *Eugenia*, stating also that they differ from the latter genus in the broader staminal disk. Blume, however, has since shown that they have entirely the fruit and seeds of *Eugenia*, in which genus also there are several instances of a staminal disk at least as broad as in *Jossinia*, which must now be reduced to the section *Eueugenia*.

Myrciaria, Berg, contains a considerable number of American species, distinguished from *Eueugenia* by the calyx-tube produced above the ovary, as in *Aulomyrcia*, *Jambosa*, &c., and by the ovules, two in each cell (as in *Myrcia*), not several (as in all other *Eugeniæ*). Had these characters been accompanied by any general difference in habit or inflorescence, they might have well served to maintain the genus; but some of the five series under which the species are classed, are more generally different from each other than from corresponding groups of *Eugenia*. The first series, *Dichotomæ*, have the inflorescence of *Myrcia*, and will probably prove to belong to that genus, the fruit of the three species referred to it being at present unknown. The *Paniculatæ* require further elucidation, the fruits of several of them also not having been described. The *Glomeratæ* and *Laterifloræ* constitute a more natural group, which we may, with Grisebach,

consider a good section of *Eugenia*, although, in inflorescence, passing into *Eueugenia*.

Siphoneugenia, Berg, has three species, with the calyx-tube produced, as in *Myrciaria*, but with the ovules and inflorescence of *Eueugenia*. *Catinga*, Aubl., has the inflorescence of *Myrciaria*, with the calyx and ovules of *Eueugenia*.

Cleistocalyx, Blume, is unknown to me, except from the description and figure of Blume, Mus. Bot. i. 84, t. 56. It is represented in bud only, with detached fruits, which are entirely those of *Eugenia*, to which genus Miquel refers the plant. The figure in bud is that of *Acicalyptus*; but Blume describes the calyx-limb (closed before flowering, as in *Acicalyptus*) as splitting into four or five irregular lobes before it falls, instead of cohering in a circumsciss operculum; this, however, may have been accidental in a single detached calyx, or even conjectural; for, if well ascertained as an essential character, it would have been represented in the figure. Should *Acicalyptus* really prove to have a Eugenioid embryo, it might be united with *Cleistocalyx* in a genus closely allied to *Eugenia*, but differing from its section *Jambosa* (as *Calyptranthes* does from *Myrcia*) by the operculate calyx; and such genus would probably, notwithstanding a slight difference in the placentation, include also *Piliocalyx*, recently proposed by Brongniart and Gris, if the embryo, as yet unknown, should prove to be that of *Eugenia*.

Calycorectes, Berg, including *Schizocalyx*, Berg, contains a few American species differing considerably from each other in aspect, but supposed to be all characterized by a Psidium-like calyx with a Eugenioid embryo, thus differing from *Eueugenia* as *Cleistocalyx* does from *Jambosa*. The seed, however, appears to have been examined only in one species; and none of our specimens have ripe fruit; and it is with doubt that we have temporarily retained the genus.

Aulacocarpus, Berg, comprises two American species, with the habit and inflorescence of the large-leaved *Eueugeniæ* or Catingas. Their flowers are unknown; but the fruits differ from the majority of *Eugenia* in the very hard thick pericarp, separating when dry more or less readily into 1-seeded pyrenes. How far that may take place in any true *Eugenia* we do not know. The fruit of *Eugenia* was originally supposed to be a drupe.

Cupheanthus, Seem., which we had placed amongst genera of doubtful affinity, has been further elucidated by the observations of Brongniart and Gris and by the notes of Vieillard, our

conjecture that *Gaslondia* of the latter botanist was the same genus having proved correct. Messrs. Brongniart and Gris show that it agrees in all respects with *Eugenia* (sect. *Jambosa*), except that the flowers are 3-merous—a character which, I believe, in the whole tribe occurs only in one or two species of *Myrcia*. If, however, it prove constant, it may serve to maintain the genus, although in close proximity to *Eugenia*.

Tribe IV. Lecythideæ.

The three well-known subtribes Barringtonieæ, Lecythideæ, and Napoleoneæ, which we have thought might well be grouped into a tribe under the name of Lecythideæ, require no comment on the present occasion. We have proposed no alteration in the circumscription of the thirteen genera of which the tribe is composed, the American ones having been well distinguished by Berg, and the Asiatic ones by Blume and others; I have already had occasion to allude to the affinities of *Napoleona* in a note on *Asteranthos*, printed in the third vol. of our Journal; and the curious anomalies in the stamens and staminodia of these two genera will, I believe, be fully discussed in a paper prepared for the Society by Dr. Masters.

A List of the Musci collected by the Rev. Thomas Powell in the Samoa or Navigator's Islands. By William Mitten, Esq., A.L.S.

(With two Plates.)

[Read March 7, 1867.]

The Mosses enumerated in the following pages have been gathered chiefly in the Island of Tutuila. Including a few incomplete specimens, about 100 species have been obtained; with only two or three exceptions, all are from the bark of trees or from decayed wood. As might have been expected, the Samoan Musci manifest a close correspondence with those inhabiting the Figi Islands, and with them approach generally most nearly to the forms which appear especially to belong to the islands of the Indian Archipelago. Conspicuous amongst Mr. Powell's collection are two species of *Spiridens*, generally resembling the original *S. Rienwardtii* of Java, but both more robust—and two species of *Garovaglia*, also closely corresponding with other species found in Java and the Moluccas. Accompanying these, Mr. Powell has found a new genus, in its leaves and habit very nearly resembling the Tropical-American *Helicophyllum*, and another in all respects