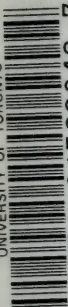
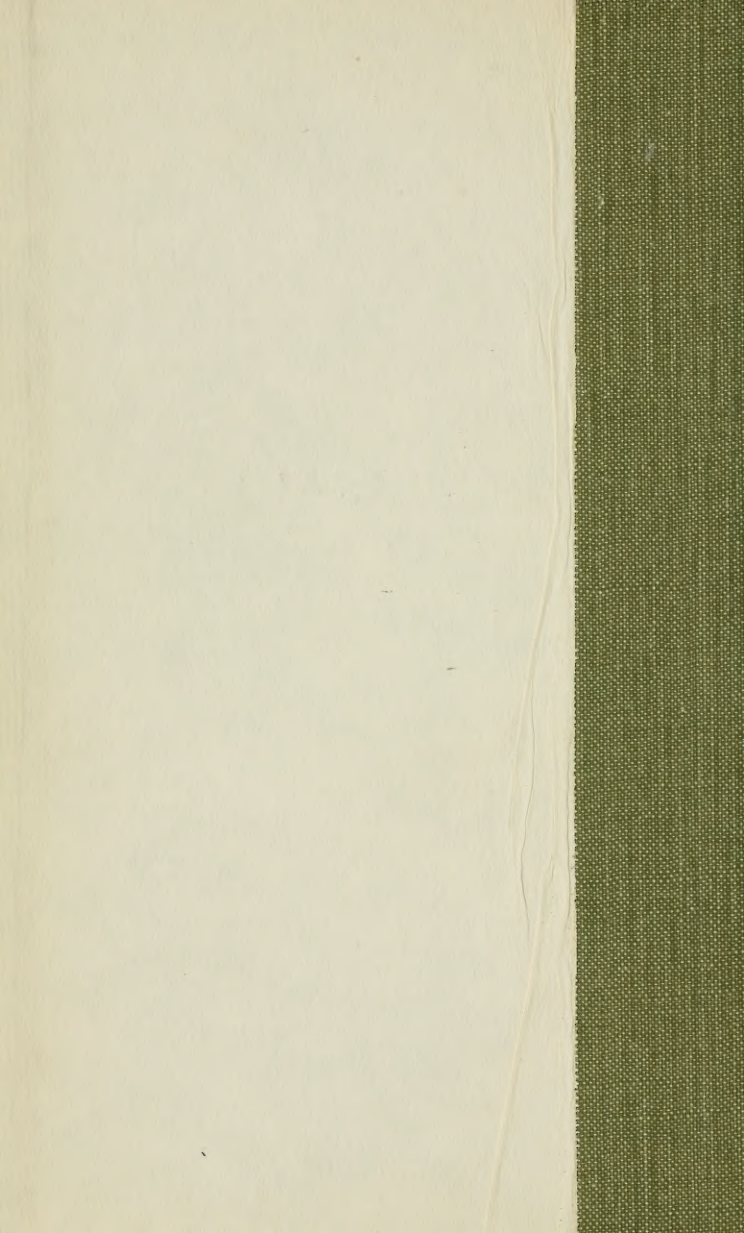


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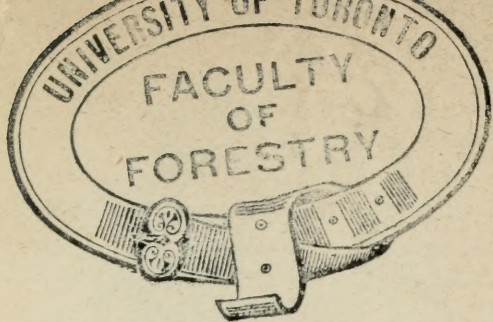
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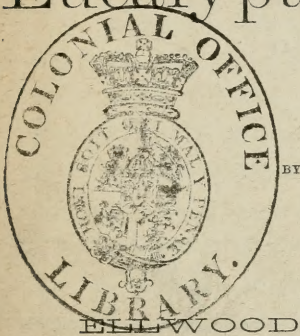


Eucalyptus Globulus.

FOREST CULTURE

AND

Eucalyptus Trees.



ELLWOOD COOPER.

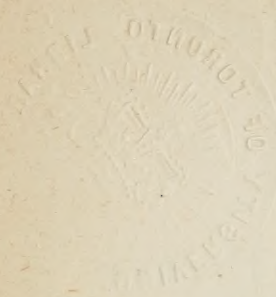
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PREFACE.

The preface to this volume may be written in a few words. It contains the results of the comprehensive and scholarly study of Australia's great botanist, BARON FERDINAND VON MUELLER. It is invaluable as a work of reference to those who are about entering upon, and to those already engaged in the Cultivation of Forest Trees, and especially to those interested in ARBORICULTURE in CALIFORNIA; since the climate and other conditions influencing the growth of vegetation in the two countries are the same.

ELLWOOD COOPER.

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FOREST CULTURE

IN ITS

RELATIONS TO INDUSTRIAL PURSUITS :

A LECTURE,

DELIVERED BY

Baron Ferd. von Mueller, C.M.G., M.D., Ph.D., F.R.S.

(Government Botanist for Victoria, and Director of the Botanic Gardens of Melbourne),

On the 22d of June, 1871.

"The toils of science swell the wealth of art."

BULWER LYTTON, from Schiller.

Strange as it may appear, an impression seems to be prevailing in these communities that our forests have to serve no other purposes but to provide wood for our immediate and present wants, be it fuel or timber. For even after the warning of climatic changes, and after the commencing scarcity of wood, no forest administration, at least none adequate or regularly organized, has been initiated in any portion of Australia; and thus the forests, even in districts already very populous, remain almost unguarded, become extensively reduced, and in some localities are already annihilated; indeed, the requirements of the current time alone are kept in view. Under such circumstances it cannot be surprising that neither an

universal forest supervision, nor a judicious restraint of consumption, nor an ample utilization of *all* the various collateral resources of our woodlands, received that serious attention to which such measures became more and more entitled.

During the earlier years of our colonization, while the population was but thinly scattered over the territory, or densely concentrated in a few places only, all demands on the wood resources were comparatively so limited as to cause, perhaps, nowhere vast destruction of the timber vegetation, much less any alarm for meeting the requirements of the future. Then followed the first gold period, with all its bustle, turmoils and agitations, preventing reflection on almost anything except the immediate wants of that stormy time. Subsequently, when the commotion and excitement of the earlier gold era had calmed down, other obstacles arose, which, in their conflicts, brought much sadness on this young country, and retarded for years its full progress. But now, when apparently also these difficulties have been surmounted, it will be all the more incumbent on our statesmen and legislators to exclude no longer from their consideration and watchfulness that remaining portion of a bequest which bountiful Nature, in its rich woods, has intrusted to our care. The maintenance of these forest riches should engage not only the loftiest forethought, but also a well-guided and scrupulous vigilance.

How forests beneficially affect a clime, how they supply equable humidity, how they afford extensive shelter, create springs, and control the flow of rivers—all this the teachings of science, the records of history, and more forcibly still, the sufferings or even ruin of

numerous and vast communities, have demonstrated in sad experiences, not only in times long past, but even in very recent periods. In what manner the forests arrest passing miasmata, or set a limit to the spreading of rust-spores from ruined cornfields; in what manner their humid atmosphere and their feathered singers effectually obstruct the march of armies of locusts in the Orient, or hinder the progress of vast masses of acrydia in North America, or oppose the wanderings of other insects elsewhere — all this has been clearly witnessed in our own age. How the forests, as slow conductors of heat, lessen the temperature of warm climes, or banish siroccos; how forests, as ready conductors of electricity, much influence and attract the current of the vapors, or impede the elastic flow of the air, with its storms and its humidity, far above the actual height of the trees, and how they condense the moisture of the clouds by lowering the temperature of the atmosphere, has over and over again been ascertained by many a thoughtful observer. In what mode forests shelter the soil from solar heat, and produce coolness through radiation from the endlessly-multiplied surfaces of their leaves, and through the process of exhalations; how, in the spongy stratum of decaying vegetable remnants, they retain far more humidity than even cultivated soil; how they with avidity re-absorb the surplus of moisture from the air, and refresh by a never-wanting dew all vegetation within them and in their vicinity, has been explained, not only by natural philosophy, but also often by observations of the plainest kind. How forest-trees, by the powerful penetration of their roots, decompose the rocks, and force unceasingly from deep

strata the mineral elements of vegetable nutrition to the surface; how they create and maintain the sources for the gentle flow of watercourses for motive power, aqueducts, irrigation, water-traffic and navigation; how they mitigate or prevent malarious influences — of all this we become cognizant by daily experiences almost everywhere around us. We have to look, therefore, far beyond a mere temporary wood supply, when we wish to estimate the blessings of forest vegetation rightly; and our mind has to grasp the complex causes and sequences originating with and depending on the forests, before their value as a total can be understood.

“ Here, in the sultriest season, let us rest :
Fresh is the green beneath those aged trees ;
Here air of gentlest wing will fan our breast—
From heaven itself we may inhale the breeze.”

BYRON.

Let us then take timely warning; let us remember that denuded earth parts with its warmth by radiation, and is intensely heated by insulation; that thus in woodless countries the extremes of climate are brought about in rendering the Winter-cold far more intense and boisterous, and the Summer-heat far more burning and oppressive. Let us remember why the absence or destruction of forests involves periodic floods and droughts, with all the great disasters inseparable therefrom. Let us bear in mind that even in our praised Australia many a pastoral tenant saw his herds and flocks perish, and even the very kangaroos off his run; how he looked hopefully for months and months at every promising cloud which drew up on the horizon, only to dissolve rainless in the dry desert air; whereas, when the squatter's ruin was completed,

the last pasture parched, and the last waterpool dried up, great atmospheric changes would send the rain-clouds over the thirsty land with all the vehemence of precipitation, and would convert dry creeks into foaming torrents, or inundate with furious floods the very pastures over which the carcasses of the famished cattle and sheep were strewn about ! Picture to yourselves the ruined occupant of the soil, hardly able to escape with his bare life from the sudden scenes of these tragic disasters ! Fortunately, as yet such extreme events may not have happened commonly ; yet they did occur, and pronounced their lessons impressively. Let it be well considered that it is not alone the injudicious overstocking of many a pasture, or the want of water-storage, but frequently the very want of rain itself for years in extensive woodless districts, which renders occupation of many of our inland tracts so precarious. Let it also not be forgotten how, without a due proportion of woodland, no country can be great and prosperous ! Remember how whole mountain districts of Southern Europe became, with the fall of the forests, utterly depopulated ; how the gushes of wide currents washed away all arable soil, while the bordering flat land became buried in debris ; how its rivers became filled with sediment, while the population of the lowland were at the same time involved in poverty and ruin ! Let us recollect that in many places the remaining alpine inhabitant had to toil with his very fuel for many miles up to the once wooded hills, where barrenness and bleakness would perhaps no longer allow a tree to vegetate ! It should be borne in mind that the productiveness of cereal fields is often increased at the rate of fully fifty

per cent. merely by establishing plantations of shelter-trees ; that the progress of drift-sand is checked by tree-plantations ; and that a belt of timber not only affords protection against storms, but also converts sandy wastes finally into arable meadows, thus adding almost unobserved, yet unceasingly, so far to the resources of a country.

Shall we follow, then, the example of those improvident populations who, by clearing of forests, diminished most unduly the annual fall of rain, or prevented its retention ; who caused a dearth of timber and fuel, by which not solely the operations of their artisans became already hindered or even paralyzed, but through which even many a flourishing country tract was already converted almost into a desert. Should we not rather commence to convert any desert tract into a smiling country, by thinking early and unselfishly of the requirements of those who are to follow us ? Why not rather imitate the example set by an Egyptian sovereign, who alone caused, during the earlier part of this century, 20,000,000 of trees to be planted in formerly rainless parts of his dominions.

Dr. H. Rogers, of Mauritius, issued, this year, a report "on the effects of the cutting-down of forests on the climate and health of Mauritius." Still, in 1854, the island was resorted to by invalids from India as the "pearl" of the Indian Ocean, it being then one mass of verdure. When the forests were cleared, to gain space for sugar cultivation, the rainfall diminished even there ; the rivers dwindled down to muddy streams ; the water became stagnant in cracks, revices, and natural hollows while the equable tem-

perature of the island entirely changed ; even drought was experienced in the midst of the ocean, and thunder-showers were rarely any longer witnessed. The lagoons, marshes, and swamps along the seaboard were no longer filled with water, but gave off noxious gases ; while the river-waters became impure from various refuse. After a violent inundation, in February, 1865, followed by a period of complete dryness, fever, of a low type, set in, against which the remedies employed in ordinary febrile cases proved utterly valueless. From the waterless sides of the lagoons, pestilential malaria arose, exposed to which the laborers fell on the field, and, in some instances, died within a few hours afterward. But scarcity of good food among the destitute classes, and inadequate sewage arrangement, predisposed also to the dreadful effect of the fever, at the time. As stated by myself, on a former public occasion, marshes should either be fully drained or the means of continuing them submerged should not be withdrawn. Dr. Rogers very properly insists that the plateaux and highlands of Mauritius must be replanted, alone on sanitary reasons. The small island of Malta requires, at this moment, to make strenuous effort for wood culture, to render tillage further possible and the clime more tolerable. The once forest-covered hills, which bordered the rich garden country of Murcia, in Moorish times, are now masses of arid rocks ; while Spain, nowadays, is even helpless to obtain its very fuel, and thus all its technologic industries must languish. No wonder, then, if our here much-disregarded Eucalypts are called there the trees of the future.

But I have, on this occasion, dwelt already long enough on the stern necessity of securing a due relation of forest to territory, of woods to climate, of timber to industries. These great questions have been discussed, by able men, through time long passed, in all countries of civilization. The details, moreover, of such discussions demand a special and fuller teaching, for which, perhaps, opportunities may yet arise in this hall. But to those who wish early to devote fuller attention to vital considerations of this kind, I would recommend the perusal of the admirable work of George P. Marsh (*Man and Nature; or Physical Geography, as modified by Human Action*. London: 1864). That author studied the scattered and largely foreign literature pertaining to this subject with singular care, observed very many original facts, and argued on them with great ability. A smaller, still more recent publication (*Disastrous Effects of the Destruction of Forest Trees in Wisconsin*, by Lapham, Knapp, and Crocker, published in 1867) is also deserving full attention, inasmuch as it brings before us the difficulties and losses which the destruction of the forests has already caused in one of the younger of the American States; while, again, Indian experiences in regard to forests may be traced in the valuable volume issued by Dr. Cleghorn (*Forests of the Punjab and Western Himalaya*; Roor Kee, 1864). Some observations of my own, applying to countries like North Africa, have been recorded two years ago in the *Bulletin de la Societe d' Agriculture d' Alger*.

One of the main objects, however, of my address this evening, is to show in what manner a well-organized and yet inexpensive system of forest admin-

istration might check the indiscriminate destruction of the woods, without, perhaps, lessening the rate of the present yield ; in what manner numerous latent industrial resources of our ranges might be speedily and successfully developed, and a higher revenue thus be raised by the state ; in what manner this increased income could be best employed, to maintain or enrich the forests, or to raise woods where naturally none existed ; and by what new means prosperous occupation might be afforded to many a happy family in the still and salubrious sylvan recesses of this country.

And here I would at once remark, that for any administrative organization to watch over our forest interests we must follow an independent path of our own in this young country, because the systems of forest management adopted with so much advantage in Germany, France, and Scandinavia are here applicable only to a very limited extent. This must be at once apparent to any one who will reflect on the disparity which exists between our clime, our native tree vegetation, our present ratio of population and value of labor, as compared with similar conditions of the older and far more densely inhabited countries of middle and northern Europe, not to speak of the very much wider scope which, for the selection of trees for our future use, the isothermal zone of Victoria allows. On the latter subject our Acclimatization Society has recently published the views which I entertain in reference to the many various trees eligible for the geographic latitudes of a colony like ours.* Next I proceed to give, though very briefly, only an outline of the special system of administration, which I would

* Appendix to the Annual Report of the Vict. Acclimat. Soc., 1870-71.

advise to be adopted in the first instance, as well for the supervision, enrichment, and utilization of our native forests as for creating also new ones. On various occasions I have alluded to such a plan of surveillance before. More recently, though only passingly, in a lecture delivered at this hall, I advocated the formation of local Forest Boards in the different districts of our colonial territory. Various considerations led me to recommend this system. The administration, as an honorary one, would involve no direct expenditure to the State. It would bring to bear in each locality special watchfulness and local talent. In each district could readily be found a few inhabitants who not only possess some knowledge of tree-culture in general, but who, also, by their direct interest in the present and future welfare of the locality in which they live, in which they gained experiences, in which they hold property, and in which they reared a family, would be induced, as much for the sake of direct and lasting advantages as from patriotic motives, to devote the needful time for serving on a local Forest Board. But there are still other weighty advantages, which claim support for this proposition. Various tracts of the Victorian territory are—as might be imagined—very unlike in climate and geologic structure. Each locality shows peculiar adaptabilities for special trees to be selected. One district can afford, by the possession of more extensive primeval forests, to be far more heavily taxed in its timber resources than another; one tract of country can produce remuneratively certain trees, which it would be hopeless to attempt raising in another locality. Some extensive areas have no forests at all, and in others they

have all but succumbed already. Hence each Forest Board can best frame its own by-laws or local regulations, subject to the approval of ministerial authority ; each can best judge of its own particular requirements, not only for the present generation, but also of such as will be urgent at a time when the children and grand-children of the earlier colonists will have to form their judgment on the wisdom or shortcomings of their ancestors here at a time when the want of foresight may fall most crushingly on the vitality or progress of many an industry or even the whole prosperity of the colony, or when, otherwise, the early operations of thoughtful local residents will prove to posterity an incalculable benefit. It will then become apparent whether the present colonists have done their duty to their descendants, and have been faithful to the future interests of their adopted country ; or whether they sunk all their ideas and efforts in temporary gain, regardless of all consequences. Each forest district, thus guarded by local administrators, will be able to produce a far larger income than now is raised from any of our wood areas ; while the removal of timber will be brought within more reasonable bounds, and the wants of the future no longer be disregarded. Means of disposal of the wood, different to the regulations now in force, would be adopted, to save, in places much denuded already of wood, the rest of the timber from complete destruction. Thus, for instance, trees might be sold by numbers at certain sizes, with saving of the youthful trees ; or the wood might be removed by the square mile, with a view of replanting. The reckless ringing of trees (merely to obtain a little more grass) and stripping of

bark would be brought within stringent laws, and many other losses be obviated.

A gentleman at Hillesley counts, as late as this very month, five splendid trees on an acre, cut down by the splitters, while only about one tenth of the wood is used; nine tenths being left to be swept away, sooner or later, by bush-fires. This improvidence goes on within a few hours' drive from Melbourne. The stately sea-coast Banksias (*Banksia integrifolia*), so rare near Melbourne, and hardly occurring further westward, have been nearly exterminated within this month, as near to us as Brighton. On all this, local forest surveillance can form far the best opinion. Each Board should have its cultivator, who, simultaneously, could perform the duties of forest-ranger. A few unprovided orphan boys might be occupied in the simple nursery or planting work for the forests. The officer intrusted with forest duties on behalf of the Government might aid, by frequent visits to each forest district, the various Boards with much advice. The expenditure for such an organization in each instance would be most moderate, would be productive already of early remunerative gain, and cause large and immediate savings. No statesman, I feel assured, would wish to impoverish our woods at the expense of the next generation, just as little as any legislator would hesitate to re-vote annually, for each forest administration, at least a portion of the revenue raised from the woods under its control. A sound economy of the State will not expect from a forest in populous localities any more than to devote its means for self-support. One of the first duties devolving on any forest department would undoubtedly be to cause

in each district some fertile, sheltered valleys, readily accessible to good lines of traffic, to be selected, where, from springs or rivulets, water could be obtained for inexpensive irrigation, in order to reserve such spots for forest nurseries before they are all alienated from the Crown. The transit of the millions of seedlings needed for forest plantations, from remote spots, would not only be one of enormous and unnecessary expenditure, but, in the many instances of evergreen and even some deciduous trees, it would be next to impossible to convey living plants for long distances. The union of Forest Boards to Road Boards or Shire Councils I regard inadvisable, because their scope of action is so different. The predilections of a member of a municipality will often be in building operations and kindred objects, while for culture processes he may have neither inclination nor experience. It is never wise to burden too heavy responsibilities on a few honorary administrators, whose leisure in this youthful country, where so much work is yet under the first or early process of creating, is almost sure to be but limited.

But there are instances in which—as, indeed, a thoughtful legislator has suggested—the Mining Boards might exercise, in their vicinity, supervision also over the woods. On many professional questions, such as the renovation of forests, the best utilization of their products, the increase of their riches, I would, myself, very gladly afford advice, and thus maintain a consulting position to the Forest Boards; for, need I add, it has ever been my aim to serve, as far as it was within my means, the best interests of my fellow-colonists; and while official responsibility

rests on me in this direction, I would wish to meet it in such a way that those who will live after us shall never be able to tax me with blindness to any important interest of our colony, so far as such were intrusted to my charge. But, then, the views of a professional officer should be received with that consideration, and be seconded with that support, to which they have fair claim.

I pass the subject of the incalculable value of the native woods, such as we still possess in our own forests, whether viewed in their relation to arts or as mercantile export commodities. It is a matter far too large to dwell on, even cursorily, on this occasion. Were I to enumerate all the uses already practically known of our native trees, I would have to compile a goodly volume, even were I silent on the still far ampler subject of the introduction of the thousands of different foreign trees which I should like to see here for the use of future artisans and those who are to benefit by their services. A work bearing on the nature of the forest-trees of India, by Dr. Balfour, was kindly placed in my hands by Col. Sankey, whose stay among us we at present (22d June, 1871) enjoy for advice on our water-works. Major Beddome, of Madras, issues a kindred illustrated work.

I may, however, be allowed to point to the enormous consumption of indigenous wood in some localities, as this expenditure is utterly out of all proportion to the existing supply or its present natural renovation. This question presents itself all the more gravely, as no rich coal-seams are as yet discovered, by which the fuel-supply could be augmented from short distances, at a moderate price. We have also to be

cognizant that we cannot think of coal-fields as inexhaustible, even in the richest coal countries; and, although it is to be hoped that the day is very distant when the cheap results of colliery work will be marred by the much-increasing depth of the coal mines, or their partial exhaustion, yet we cannot altogether discard the idea that, so far as coals are concerned, we are working on a capital, however large it may be, without ever adding to it. In Victoria, we can neither augment the supply of burning material by peat, such as is so extensively utilized for fuel in the countries of the North, except we bring a very similar and equally useful peat from the distant and rugged heights of our Alpine mountains.

Although science has promised us prophetically other sources for applied heat—and I may add, motive power—in gases not yet within our technic reach or of universal application, we have, nevertheless, to deal with the stern realities of the day until new scientific achievements in this direction shall have been accomplished. At best, and looking ever so hopefully forward to the successes of the future, we cannot substitute in an endless array of purposes air or coal for the ever-wanted living wood, even if all that concerns climate and health could be left out of our contemplation. As an instance, then, of our present consumption, or almost immediate requirements of wood, I would like to quote one or two examples.

The able Engineer-in-chief of the Railway Department—T. Higinbotham, Esq.—has obligingly supplied me with the following data in reference to the timber at present consumed for the Government railway lines. This gentleman explains also what will

most likely be needed within the next few years for this purpose.

“The number of sleepers which are used annually on the existing lines of railway, to replace decayed sleepers, is about forty thousand; and there can be no doubt that renewals at this rate at least must be continued for many years to come. Each sleeper contains three and one eighth cubic feet of timber, and for renewals Red Gum timber is used exclusively, the principal supplies being obtained from the Murray River.

“The length of fencing, which is renewed annually on the existing lines, may be taken at eighteen miles, and the quantity of timber in a mile of fencing is about three thousand cubic feet; the timber used in renewing fencing is Messmate, Peppermint, and Stringybark, and the durability of these timbers when used for fencing may be taken at ten years.

“There are at present nearly one hundred and twenty miles of new railway in course of construction, and sixty miles more will be undertaken before the close of this year. The new line of railway, the North-eastern, will be one hundred and eighty-one miles long, and for each mile two thousand sleepers are required, which at three and one eighth cubic feet per sleeper gives six thousand two hundred and fifty cubic feet per mile; or, for the whole length of one hundred and eighty-one miles, one million one hundred and thirty-one thousand two hundred and fifty cubic feet will be required for sleepers. The timber to be used in these sleepers will be Red Gum, Iron-bark, or Box. I have no actual experience of the durability of these timbers when used for sleepers; but I believe

that it will be quite safe to reckon on their lasting for eighteen years. The ordinary Gums, when used for sleepers, will not last more than half that time.

“The quantity of timber required for fencing the North-eastern railway will be one million eighty-six thousand cubic feet. The fence-posts will be of Red Gum, Iron-bark, Blue Gum, or Box, and the rails of Stringy-bark. I think that a fence of these materials will last for eighteen years. As to projected railways, it seems to be probable that on the average from thirty to forty miles will be made for the next ten years, in addition to the North-eastern railway already in progress.”

I am further told, by a gentleman conversant with our railway affairs, that the engines on the present Government line use about three thousand tons of wood a year, while about eight hundred tons more are consumed on the stations. The Government line requires one hundred and fifty thousand Blackwood keys annually. On inquiry, I have also learned that the breakwater at Williamstown will take four hundred piles, equal to eighteen thousand cubic feet, and for the superstructure of the piers ten thousand cubic feet more. The Melbourne Gas-works required, in 1870, not less than forty thousand superficial feet of Red Gum timber. The quantity of Red Gum wood required for these and other purposes cannot be increased by supplies from Tasmania, as the tree does not exist there. Again: the true Blue Gum-tree does not naturally occur beyond Victoria and Tasmania. If complete wood statistics could be collected, both of our daily requirements in town, on land, and on sea, and statistics also as to what really sound and

straight timber is still available, some serious realities would be brought before us.

At Ballarat, Creswick, Beechworth, Yackandandah, Sandhurst, Heathcote, Maryborough, Avoca, Castlemaine, Fryer's Creek, and Ararat, some of the timber for the mines has to be brought already from distances as remote as ten to sixteen miles, according to returns of the Mining Surveyor, kindly furnished by Mr. R. Brough Smyth. At Pleasant Creek the miners have to go every year a mile further for their wood.

I quote the following important statement from Mr. R. B. Smyth's Mineral Statistics of Victoria for 1870 :

Table showing approximately the Quantity and Cost of Timber consumed annually for Mining Purposes in the several Mining Districts, from returns made by the Mining Surveyors and Registrars.

		£	s.	d.
BALLARAT.....	{ Firewood, etc. 320,601 tons. Props and cap-pieces....1,650,555 pcs. Laths and slabs.....4,274,798 pcs. Sawn timber.....5,772,110 feet. }	203,024	4	7
BEECHWORTH...	{ Firewood, etc. 45,600 tons. Props and cap-pieces.... 155,778 pcs. Laths and slabs..... 566,050 pcs. Sawn timber..... 706,200 feet. }	33,639	17	4
SANDHURST.....	{ Firewood, etc. 129,750 tons. Props and cap-pieces.... 290,300 pcs. Laths and slabs.....1,174,500 pcs. Sawn lumber 614,800 feet. }	91,551	8	4
MARYBOROUGH. }	{ Firewood, etc. 98,373 tons. Props and cap-pieces.... 198,071 pcs. Laths and slabs..... 809,182 pcs. Sawn timber 786,987 feet. }	53,647	4	3
CASTLEMAINE... }	{ Firewood, etc..... 68,190 tons. Props and cap-pieces.... 142,791 pcs. Laths and slabs..... 109,143 pcs. Sawn timber..... 456,100 feet. }	29,581	14	5
ARARAT.....	{ Firewood, etc. 91,360 tons. Props and cap-pieces.... 19,302 pcs. Laths and slabs..... 70,021 pcs. Sawn timber..... 250,000 feet. }	23,934	0	11
GIPPS LAND.... }	{ Firewood, etc..... 12,744 tons. Props and cap-pieces.... 37,656 pcs. Laths and slabs..... 18,802 pcs. Sawn timber..... 202,581 feet. }	9,508	4	3
Total Cost.....		£444,886	14	1

As a further evidence of the imperative necessity of finding wood by a mode different to the present means of obtaining it I translate and condense a portion of a letter from an accomplished mining engineer at Clunes (Wolfgang Mueller, Esq.), a spot which once boasted of forest scenery : The fuel required for the steam - engines alone at the mines of Clunes amounts, at the present rate of working, to not less than one million three hundred and eight thousand cubic feet annually. The nearest forest is ten miles distant ; the price per cord (of one hundred and twenty-eight cubic feet) is 27s. The cost of transit of the above engine-fuel amounts alone to, approximately, £10,000 pro anno ; the whole expenditure being about £15,000. The round wood, for subterranean use in the mines of Clunes, now annually comes to one hundred and sixty thousand running feet, at a value of £2,400 ; and this round wood cannot now be obtained nearer than from twenty to twenty - five miles. The sawn and split timber for the Clunes mines has to be carried quite as far, adding about £700 to the wood expenses for these mines, the total being probably not less than £20,000 annually ! No allowance is, however, made in these calculations for the domestic fuel of the miners. The price of wood is trebled already by cartage at that spot.

No natural local upgrowth, even if not destroyed by fire or traffic, I am confident can come up to this rate of consumption ; and it is evident that annually the price for wood at these mining works must increase ; for many mine this may become a question altogether as to the possibility of its further remunerative working. The mining operations, moreover, are

generally at a yearly increase, through new gold discoveries in the district spoken of, and elsewhere. Although, on the Clunes mines, the price of wood has not materially risen during the last six years, it must be borne in mind that remuneration of labor has sunk, indicating, in reality, a considerable increase in the price of the fuel. New railway lines may, certainly, bring wood, for a time, at moderate prices, to the miners; but this measure copes not with the real difficulty of the wood question, but only defers it, as such sources of supply will also become exhausted, while carriage, from an indefinite distance, will become a financial impossibility. The present price of coal, at Clunes, is far too high to allow it to be substituted for wood. Now let us pass on to still other considerations bearing on this question. It so happens that the decrease of timber in our colonies is hastened by other agencies than those of sacrifice for utilitarian supply. Irrespective of the ordinary causes by which, in many countries, the virgin forests became devastated, there are, additionally, others which operate in our colony to augment the extensive destruction of woods. The miner ignites the underwood, with a view of uncovering any quartz-reefs or tracing mineral riches of other kinds. Although he desires only to force thus his way through a limited space of scrub, or uncover, for inspection, a small extent of ground, he really sets, sometimes, the whole forest on fire, unchaining the furies of the fiery element, which, in its ruinous and rapid progress, consumes innumerable stately trees, requiring the growth of one or even several centuries to attain their spacious dimensions. The burning trees, a prey of the flames, carry with them many others in their fall;

others become partially scorched, and linger gradually to decay ; others become at least so far impaired as to offer no longer a sound or superior timber. Very aged Eucalyptus-trees are almost always suffering already from natural decay in the central portions of the stem. It is far from me to wish to impede the operations and progress of the miners, to whose intelligence and hard-working activity this country owes so much ; but the advantages of gold-mining in our ranges may sometimes be too dearly bought at the expense of very extensive forest-destruction, with all the evils concomitant to it, or sure to follow it. Many other causes—such as the carelessness of travelers—set also frequently portions of the forest on fire, while the control over the devastation is lost.

The answer to remonstrances amounts usually to an opinion that more wood is springing up again than has been destroyed ; but let us ask, how long will it be until the suckers, saplings, or seedlings, which, undoubtedly, in many instances, occupy the burned ground, forming perhaps impenetrable thickets, until they will really have advanced to the size of timber-trees, fit for the saw - mill ? In other localities, less densely wooded, where the trees were so dispersed as to give to the natural scenery, before it was disturbed, a park-like appearance, in such localities, which impressed on many of the original Australian landscapes so much peculiarity, the growth of bushy plants becomes, as a rule, by occupation of the ground, quickly destroyed ; the shelter and shade, which kept the mostly rather horizontal roots of the Eucalyptus trees cool and moist, become largely withdrawn ; the pendent leaves and lax or distant ramifications of the

tree itself giving but partial shade. The soil, moreover, remains no longer porous and permeable to moisture—it gets hardened, bare and consolidated by traffic and heat; the necessary moisture is wanting to keep the bark pliable, and to maintain the circulation of the sap active or normal; bark and wood are getting fissured and partly lifeless; and now places of seclusion, as well as a wood fit for their ready attack, are given to numerous kinds of coleopterous and other insects, which, by boring the ligneous tissue, are sure to complete the destruction of the trees. Pictures of absolute misery of this kind may be noticed around our city in all directions. I have succeeded in saving many a venerable tree on the ground under my control, and in arresting the incipient decay by merely surrounding the base of the stem with earth turfed over, serving as seats; or by removing the endless quantity of mistletoe, which sucks the life-sap out of the branches, the invader perishing with its victim, there being no longer a multitude of native birds in populous localities to devour the mistle-berries. In many low localities, again, the ground, indurated by traffic, collects a superabundance of moisture, which becomes stagnant, and detrimental to the trees of such spots. Various other peculiar causes tend to the decay of our trees: to allude to all is beyond our present object.

How to provide, therefore, in time, the wood necessary for our mines, railways, buildings, fences, and as well as for the ordinary domestic and other purposes, becomes a question which from year to year presses with increased urgency on our attention, the consideration of which we have already far too long

deferred. It may certainly be argued that in the eastern portion and some of the southern parts of the Victorian territory abundance of forests still exist—enough to supply all wants for many years to come. This is perfectly true in the abstract; but how does this argument apply, when we well know that such timber occurs in secluded places, mostly on high and broken ranges, without roads. And even if the latter were constructed—which certainly will be required gradually—at what price can such timber be conveyed to the required distance? Suppose, however, that all these difficulties had been overcome, whence are we to obtain the deals of northern Pines, the boards of the Red Cedar, and the almost endless kinds of other woods which future artisans will require? For, assuredly, neither Europe nor North America can sustain the heavy call on their indigenous and even planted forests for an indefinite period to come. Tropical woods might for a time be brought from the jungles of three continents, but certainly not at a small cost. Besides, tropical trees, as a rule, are not gregarious; we cannot judge beforehand, in every instance, of their durability and other qualities; we cannot recognize their extraordinary variety of sorts specifically from mere inspection of the logs, and we should find ourselves soon surrounded by endless difficulties and perplexities were we to depend on such resources alone. Would it not be far wiser timely to create independent resources of our own, for which we have really such great facility? With equal earnestness another aspect of the timber question, as concerning our national economy, forces itself on our reflection. The inhabitable space of the globe is not

likely to increase, except through forces which would initiate a new organic creation, or, at all events, bring the present phase in the world's history to a close; but while the area of land does not increase, mankind, in spite of deadly plagues, of the horrors of warfare, and of unaccountable oppressions and miseries, which more extended education and the highest standard of morals can only reduce or subdue — mankind, in spite of all this, increases numerically so rapidly that before long more space must be gained for its very existence. Where can we look for the needful space? Is it in the tropic zones, with their humid heat and depressing action on our energies? Or is it in the frigid zone, which sustains but a limited number of forms of organism? Or is it rather in the temperate and particularly *our* warm temperate zone, that we have to offer the means of subsistence to our fellow-men, closely located as they in future must be? But this formation of dense and at the same time also thriving settlements, how is it to be carried out, unless, indeed, we place not merely our soil at the disposal of our coming brethren, but offer with this soil also the indispensable requisite of a vigorous industrial life, among which requisites the easy and inexpensive access to a sufficiency of wood stands well-nigh foremost.

I may be met with the reply that the singular rapidity of the growth of Australian trees is such as to bring within the scope of each generation all that is required, as far as wood is concerned; and as a corollary it would follow that each generation should take advantage of the facility thus brought locally within its reach. I can assure this audience that

enlightened nations abroad do far more than this, and would not rest satisfied with the greater facilities here enjoyed; they provide, with keen forethought and high appreciation of their duty for their followers, that beforehand which cannot be called forth at any time at will. If we examine this part of the question more closely, we shall find much to think about—much to act upon. Not even all our Eucalypts are of rapid growth; they, further, belong to a tribe of trees with a hard kind of wood, which, though so valuable for a multitude of purposes, cannot supply all that the needs of life daily demand from us for our industrial work.

The quick-growing Eucalypts, among which the Blue Gum-tree of this colony and Tasmania stands pre-eminent, are comparatively few in number, nor are these few all of gigantic size. They are, moreover, restricted in their natural occurrence to limited tracts of country, from which they must be established by the hand of man in other soil for the necessities of other communities—for the gratitude of other populations. Then, again, the Pines of foreign lands, often impressing a splendor on their landscapes, must be brought to our shores—to our Alps—with an intention of utilizing every square mile of ground, however unpromising in its sterility; for, after all, that square mile represents a portion, albeit so small, of the land-surface of the globe. Look at the picture on this wall; see how the Norway Spruce (which gives us so much of our deals and tar) insinuates its massive roots through the fissures of disintegrating rocks, or, failing to penetrate the stony structure, sends its trailing roots over the surface and down the

sides of the barest rocks until they have found a genial soil, however scanty, on the edge of a precipice. Nature — ever active and laborious, ever wise and beneficent — allows the tree thus to live, thus to convert the solid bowlders finally into soil, and all the time adds unceasingly to the treasures of the dominions of man. But just as time, with its measured terms in fleet course, passes irresistably onward and irrevocably away, so also have we to await the approaching time, which all our wishes cannot accelerate in its unalterable measure.

“ Onward its course the present keeps,
Onward the constant current sweeps,
Till life is done ;
And did we judge of time aright,
The past and future in their flight
Would be as one.

Let no one fondly dream again
That hope and all her shadow-train
Will not decay ;
Fleeting as were the dreams of old,
Remembered like a tale that 's told ;
They pass away.”

LONGFELLOW (from “*Manrique*”).

We have, therefore, to await with patience these measured terms before the child in its youthful impetuosity can reach the age of its highest hopes and supposed glory — but, alas ! leaving often a far happier phase behind ; or before a tree, from its youthful grace, can have advanced to sturdy strength or lofty height, to fulfill also its destiny and offer us its gifts. We cannot call forth age at pleasure ; at best there is involved a lapse of years before a timber-tree can yield a plank, a beam, or even as much as a solid post.

I have endeavored to arrive at some idea of the

real age of the larger trees, which are sinking daily under our axes, often sacrificed unnecessarily. On this occasion, as an apt one, I may, then, explain that a period of a quarter or even half a century must elapse before a solid plank, hardened by age, can be obtained from even a rapid-growing Eucalyptus-tree. It is estimated to require twenty to twenty-five years before even a sleeper of Blue Gum-wood can be obtained from a tree planted in ordinary soil; and that double the time will elapse before a sown tree of the still more durable Red Gum Eucalyptus will furnish sleepers, such as hitherto have been in use for our railway works. But a supply of fuel from these trees may be obtained much earlier. Mr. Adam Anderson, a timber merchant of this city, concurs in this estimate.

Yet for forest operations we enjoy here advantages of two-fold kind, for which in middle Europe we are justly envied. We can disseminate quickly-growing Eucalyptus-trees in the most arid districts; we can add to them, as a first shelter, many of the native Casuarinas and Acacias, and thus gain cover for less hardy trees of other countries. On the other hand, we find in the moist and rich valleys of our ranges a vast extent of space, where, under the mild influence of the clime, sub-tropic trees could be reared million-fold; where, for instance, whole forests of the Red Cedar might be originated. Besides, we do not stand at any disadvantage if we want to raise a belt of sea-coast Pines all along the shores, or if we wish to rear the Norway Spruce, or Silver Fir, or Larch, or Weymouth Fir, or the Douglas Pine, or any of the Pitch-pines of North America; because we can call forth, if

we like, whole forests of them on sub-alpine heights, never yet thus utilized.

Suppose we reckon that one hundred forest-trees would be required to be planted on an acre, allowing for periodic thinning out; and assuming that for climatic and hygienic considerations, as well as for the maintenance of wood supply, we should require finally one fourth of our Victorian territory kept as a forest-area, we would expect to possess one billion five hundred and sixty-eight million trees, and to provide for their timely restoration in proportion to their removal or natural loss.

Most of us are lulled into security by seeing that we receive, as yet, our foreign woods in the course of ordinary traffic, and we are not easily inclined to think that the supply may cease suddenly, or be obtainable only at an exorbitant expense. Even in the United States of America there are places where the price of fuel and timber has already risen fourfold. We are told that recently, in the States of Wisconsin and Michigan alone, during one single year, two million of Pine-trees were cut for lumber; and it is estimated that at the present rate of destruction no timber-trees will be left in those States after fifty years, while it will take a century to replace them, if even this be possible. Quebec exported, in 1860, not less than seventy million cubic feet of squared or sawn timber, equal to about a million tons of wood—a large share yielded by the Weymouth Pine (*Pinus strobus*)—not taking into account the current local consumption. This tree, yielding the white American Pine-wood, requires fully sixty years of growth before it can be sawn into timber of any good size. During the first

two years of the recent civil war in North America, twenty-eight thousand Walnut-trees were felled to supply one single European factory with the material for gun-stocks, demanded for this fratricidal war. Is it not right to reflect timely on the vast extensions of railroads, manufactures, mines, ship-building, dwellings, and so forth, and then to ask, Where is the wood-supply to come from? The requirements in this direction must necessarily rise with the increase of the population and the augmented refinements of civilization, yet the area of supply we see constantly decreasing. The loss on wheat crops during four of the more recent years in the State of Michigan alone, for want of shelter against cutting winds, was estimated at £5,000,000, and this is regarded as the mere sequence of the removal of the forests, and not traceable to exhaustive culture. Cereal crops and vines were destroyed in many parts of South Europe, also, through the complete want of shelter.

“ More bleak to view the hills at length recede,
 And less luxuriant, smoother vales extend;
 Immense horizon bounded plains succeed—
 Far as the eye discerns, without an end.”

BYRON.

The Commissioner of the Land Office of the United States (Report for 1868) considers the Live Oak (*Quercus virens*)—one of the best for ship-building—nearly exterminated for all practical purposes, at least as far as native forests are concerned; while the Walnut timber of North America, so much prized for cabinet-work, has well-nigh shared the same fate. The transit of Walnut-wood from Missouri to New York renders it already nearly as expensive as Mahogany, whereas the latter has become likewise in West India

and Central America an article of great scarcity, and, therefore, this important tree should be copiously planted in the forests of tropical Australia. In the earlier part of this century the supply of Saul timber of Lower India (*Shorea robusta*) was thought inexhaustible; but now, already, this heavy and durable wood is hardly any longer procurable for ship-building and engineering work, for which it is so much sought. The axes of the woodmen will also soon make such an inroad into the comparatively limited Yarra forests of West Australia that also this timber, which for salt-water works is almost incomparable, will cease to be available long before a new and sufficient supply can be raised by regular culture.

The Land Commissioner of the United States further reports, in 1868, that the frequent excessive droughts, and the occasional destructive inundations experienced a quarter of a century ago in Iowa, Kansas, and Nebraska, have much diminished since the regular settlement brought tree plantations and other cultures into the extensive treeless prairies. Iowa planted, in 1867, about seventy-six square miles of forest, and one thousand eight hundred and eighty four miles length of hedges. On the other hand, it is estimated already, in 1864, by Mr. P. T. Thomas, of New York, that the whole regions east of the Mississippi would be stripped of all really useful timber within twenty or thirty years; while even for fuel great inroads are constantly made into the American forests, coal not being everywhere accessible in the States. The Hon. T. M. Edmonds (*Report of the Department of Agriculture of U. S. for 1868*) foresees the exhaustion of the timber resources of the United States in

half a century, under existing circumstances, whereas by that time the demand will be quadrupled. Mr. Simmonds calculates the importation of wood into France during 1865 at 154,000,000 francs, or about £6,000,000, the ratio of import being at an increase, notwithstanding that the forest area of that empire was reduced, within a century, to one half—namely, from one third, in the latter part of the last century—to hardly more than one sixth now. But if the population of Middle Europe consumed proportionately as much native wood as the inhabitants of the United States, then, in less than half a century, no forest whatever would be left in Europe. These conclusions are borne out by the U. S. Commissioner of Lands, the Hon. Jos. S. Wilson. In the States east of the Mississippi, six billion cubic feet of wood were consumed for timber and fuel in 1860, at a time when no war laid hand on the forests. Hence, one million of acres of forest-land must be cleared, in the Eastern States of the Union, to find the wood for a years' local requirements. The shipment of lumber, in one of the latter years, from Chicago, was one billion four hundred million cubic feet, besides two hundred and seventeen million laths, and nine hundred and twenty-eight million shingles. In 1866, the products of the California lumber trade were one hundred and ninety million of cubic feet, and thirty-eight million shingles; in 1867, about two hundred million cubic feet. Quebec exports about one million of cubic feet since a long period, annually, irrespective of home consumption. In the Pacific States exists only a supply adequate to the prospective wants of their people. The States west of the Mississippi import already timber that

formerly existed in their own native forests. Likewise so in North America an enormous lot of trees is destroyed by girdling and subsequent burning, for clearing agricultural lands or pastoral runs. Thus, in the earlier part of the next century, every natural forest east of the Mississippi will have disappeared, if, with an increasing population, the same rate of consumption is going on. For the States west of the great river, in which forest-land is much less extensive, the prospects are still more alarming. Hence, Australia cannot indifferently look forward for soft-wood from these places.

To give some idea how long a time will elapse before actual timber, not merely firewood, is obtained from planted trees, I subjoin a brief list of the more common Middle European forest trees, together with notes of their age when eligible for various timber purposes :

Beech.....	60-110 years.
Hornbeam.....	70-100 “
Oak.....	70-120 “
Alder.....	30-80 “
Birch.....	40-70 “
Silver Fir.....	60-150 “
Norway Spruce.....	60-150 “
Scotch Fir.....	30-60 “
Larch.....	30-80 “*

That, however, in our Winterless zone, such of these trees as will endure a warmer climate would advance with more quickness to maturity must be

* It should be remembered that most of our forest ranges are naturally devoid of Pine-wood, only one species of *Callitris* occurring in a few limited mountain districts, while our second *Callitris* is a desert species. Without coniferous trees of our own we shall finally experience difficulty of obtaining the required supply of deals, pitch, turpentine, and pine-resin. Doubtless, for many wood-structures now iron is substituted, but even a ship or a house cannot be built entirely of iron, and the very production of the iron is dependent on fuel. In the absence of coal, the use of iron, involving here an expenditure for heavy freight, must necessarily be limited.

readily manifest. The accurate Customs returns for the last year show an importation of foreign woods to the value of £223,769 ; there was scarcely any export. This very month the imported building-wood sent to Sandhurst alone has cost £58,000. Some countries have not been altogether unmindful of the conservation of their forests. Germany, already much devastated at the time of the Romans, received its first forest laws as far back as the reign of Charlemagne — indeed, with the commencement of agriculture and the settling of the nomadic hunter on fixed habitations. The forests thus discontinued to be common property, and in the fourteenth century commenced already a forest economy. Full legislation, regular management and actual cultivation of trees on an extensive scale, date back one hundred and fifty years. Venice formed its forest laws already in the fifteenth century. Although the desire for ample hunting-territory gave a great impulse to the restrictions placed on the encroachment of the Middle European forests, this at the same time saved them to the country.

Within the operations of wood culture may also be included that of subduing drift-sand; and solidifying the latter finally by plantations. For this purpose can be chosen the Haleppo Pine, Cluster Pine, Scotch Fir, or our own less arboreous so-called seashore Tea-trees (*Melaleuca parviflora* and *Leptospermum lævigatum*), further the drooping She-oak (*Casuarina quadrivalvis*), the coast Honeysuckle (*Banksia integrifolia*), and also our desert cypress, or so-called Murray Pine. As not only in close vicinity to our fine city one wilderness of shifting sand exists, but as also in other places of

our shores the sand is invading villages, towns, and, perhaps, harbors, and as, moreover, many a desert spot inland may be reclaimed, I would remark that, to arrest the waves of the sand, some wickerwork or cover of brush is needed on the storm side. Large seaweeds help to form such covering. Sods of *Mesembryanthemum*, to which the unpoetic name of "Pigfaces" is here given, and which abounds on our coast, should copiously be scattered over the sand-ridges; wild cabbage, celery, sea-kale, samphire, New Zealand spinach (*Tetragonia*), chamomile, and various clovers and bloom plants should be sown, and creeping sand-grass (*Festuca litoralis*, *Triticum junceum*, Buffalo-grass, *Agrostis stolonifera*), etc., should be planted, particularly, also, sand-sedges and sand-rushes, among the best of which are *Carex arenaria*, and here the Sword Rush (*Lepidosperma gladiatum*). *Psoralea pinnata* and *Rhus typhinum*, *Prunus maritima* (the Canadian sea-coast plum), *Ailanthus glandulosa*, proved also valuable in this respect. As eligible, I may add, also, the native couch-grass (*Cynodon Dactylon*), the South African *Ehrharta gigantea*, the European *Psamma arenaria*, *Elymus arenarius* (or Lyme), even the Live-oak (*Quercus virens*); as also another American Oak (*Quercus obtusiloba*), and the Turkey Oak (*Quercus cerris*), and, perhaps, Poplars, some Willows, and, among firs, the *Pinus insignis*, *Pinus edulis*, *P. rigida*, and *P. Australis*. The common Brake Fern helps also much to conquer the sand. The New Zealand flax covers coast-sand naturally, within the very exposure of the spray.* It is need-

* Dr. Jam. Hector calculated that in New Zealand an acre of good flax land contained about one hundred thousand leaves of the *Phormium tenax*, and yields about ten tons weight of dried leaves; or, if only the outer leaves are taken, four tons. The yield of clean fiber is about twenty-three one hundredths of the green leaf.

less to remark that exclusion of traffic from the sand is imperative, as also security against ingress of goats and domestic animals of any kind, otherwise the effort is hopeless. Fencing of the area and stringent municipal laws will make, however, any operations of this kind, even without great expense, a success, as, in consequences of my advice, has been shown at Queenscliff. Wood-culture on drift-sand carries with it also the recommendation of providing the needful belt of shelter which each coast should possess. There are a few other Pines—for instance, *Pinus Taeda*, the Loblolly Pine of North America, and several other trees which grow fast in sand, whenever it is no longer moving; they endure the sea-storms, gradually consolidate the soil, and render it, in course of time, arable. In South Africa, some *Proteæ* and *Leucospermums*, the *Virgilia*, also *Myrica*, grow in coast-sand. All these planting operations must be performed very early, and in the cool season. The grasses and herbs must precede the pines and other trees. Technic industries will gain from these pines in due time.

I now beg to offer some brief data in reference to the present consumption of wood in Victoria.

After the perusal of various official returns, I am inclined to assume that twenty tons would be a fair average of the quantity of fuel consumed in each household. This would amount to rather more than three millions of tons of wood as the present annual requirement of domestic fuel in this colony. In the city and suburbs the consumption is considerably less than in the farming districts, on account of the use of coal. In reference to the return of mining-wood,

quoted on this occasion, a large allowance must yet be made for the enormous mass of wood from the felled trees, which is left unutilized in the ranges, the distance, in many cases, being too great to convey the off-fall of the timber for the purpose of fuel. The following data convey some information on the annual consumption of wood in various districts :

	Tons.
Ararat (under license).....	13,146
" (without ").....	13,146
Blackwood Mining Division.....	12,000
Buninyong.....	40,000
Colac (for saw-mills, 6,000 tons ; posts and rails, 6,000 tons ; shingles, 2,000 tons ; fuel, 30,000 tons)....	44,000
Creswick (sawn timber for Clunes, 15,000 tons ; sawn timber for Amherst, 2,000 tons ; sawn timber for Creswick, 2,500 tons ; fuel for Clunes, 30,000 tons ; fuel for Creswick, 20,000 tons).....	69,500
Castlemaine.....	37,500
Casterton.....	14,000
Daylesford (mining timber, 20,000 tons ; fuel, 50,000 tons).....	70,000
Dunkeld—sawn timber, 800,000 feet ; rails, 20,000 pieces ; Red Gum posts, 10,000 pieces.	
Eltham.....	13,600
Fryerstown.....	57,200
Geelong.....	52,000
Grant.....	4,600
Maryborough.....	200,000
Nunawading (cut under license).....	10,000
" (" without ").....	190,000
Sandhurst.....	300,000
(Another informant gives the approximate quantity used solely for fuel at 160,000 tons.)	
St. Arnaud.....	6,500
Talbot (Shire of) and Borough of Amherst—Domestic fuel for 2,887 houses, at 6 cords or 19 1-5 tons, 55,430 tons ; mining timber, 18,368 tons ; mills, 3,200 tons ; charcoal, 3,328 tons ; public institutions, 2,560 tons ; bakers, etc., 1,600 tons ; fencing and building, 6,400 tons.....	90,886

Taradale (two sevenths for mining and five sevenths for fuel).....	8,750
Tarnagulla.....20,000 to	30,000
Tylden (for fuel, 3,890 tons ; saw-mills, 15,500 tons ; for splitter's use, 2,476 tons).....	21,466
Villiers, County of (approximately).....	150,000
Whittlesea—As much as 1,800 trees are annually used for palings, shingles, etc.	
Winchelsea.....	28,600
Wood's Point.....	8,700
Woodend (for firewood and split or squared timber cut under license, wholly exclusive of that used by saw-mills).....	41,181

On the modes of raising or renovating forests, not much can be said on this occasion. For natural up-growth, perfect clearing and fencing is recommendable. Subsequently, the removal of young, crooked trees and the surplus of saplings is needed. Seedlings may be transferred from spots where they stand too densely, to more open or bare places. Suckers should be destroyed where the gain of good timber is an object. Periodic clearing of young trees is effected according to the rate of growth of the particular species ; lopping of branches is advisable should they densely meet. For broadcast sowing, the ground should be completely cleared and burnt. By breaking the ground a great acceleration of growth of the trees is attained, even to a tenfold degree. Planting in rows affords the best access for subsequent thinning and successive removal of the timber ; the Quincunx system will give approach in three directions. Pines are planted in Germany only about seven feet apart, as they require least room of all trees ; but fifteen feet is a fair distance at an age of forty years. The New Hampshire Pine stands only five or six feet apart at

an age of fifty years, and yet is not prevented by this crowded growth to be then one hundred feet high ; the stems are then very straight, eighteen inches in diameter at the base. If Pines and Oaks are promiscuously planted, then the former, which act as nurse-trees, are moved in ten or twenty years, and the ground is left to the Oak, or any other deciduous tree, at distances at first ten or twelve feet apart, and subsequently wider still. No decayed wood is left in planted forests, as it would harbor boring insects. Pines are considered not to increase much in value after eighty years, when most of them have attained full maturity, and grow only afterward slowly. Sometimes as many as one thousand two hundred Pine-trees are set out on an acre, with a view of early utilization of a portion of the young trees. The rate of growth may be much accelerated in most trees by irrigation ; hence mountain streamlets should be diverted into horizontal ditches where forests are occupying hill-sides. The best-cultivated forests of Germany are worth from three to five times as much as native woods.

For shelter plantations, intended to yield ultimately also timber and fuel to farming populations, it is recommendable to adopt the American method, according to which belts of trees are regularly planted at about quarter-mile distance ; the belts, according to circumstances, to be from four to ten rods wide, and to be formed in such direction as to front the prevailing winds. These timber-belts are usually fenced. Such shelter-trees are likely to rise to thirty feet in ten years, and have proved so advantageous as to double the farm crop, while judicious manage-

ment of these tree-belts will supply the wood necessary for the farm. There are one million and four hundred thousand square miles of treeless plains in the United States, which, in due course of time, will necessarily be converted, to a great extent, into agricultural areas on account of the generally excellent soil. The Locust-tree is much chosen for shelter purposes. Denuded wood-land, of poor soil, left undisturbed to natural renovation, has become, in some populous localities, five times as valuable as the adjoining inferior tillage or pasture-land. For the greatest profit in fuel, the trees, in some parts of North America, are cut about every sixteen years. We here, commanding Eucalypts, Acacias, and Casuarinas, would gain wood-harvests still speedier. The increased value of less fertile lands, through spontaneous upgrowth of timber, is estimated at sixteen hundredths of simple interest annually in woodless localities, no labor being expended on this method of wood-culture. Judicious management in thinning out enhances the value of such forest land still more. Wet and undrained grounds can be made to yield a return in Elms, Willows, Cottonwood, Swamp Cypress, and other swamp trees, or stony declivities in Pines and Eucalypts, at a trifling cost. For details, the forest literature, which is in Germany particularly rich, should be studied. Capitalists would likely find it safer and more profitable to secure land for timber-growth than to invest in many another speculation. After the example set at Massachusetts our agricultural societies might award premiums and medals for the best timber-plantations raised in their districts. We have societies for the protection of domestic ani-

mals, native or introduced birds, young fish, etc.; why could not a strong and widely-spreading league be organized for the saving of the native forests? Might not every child in a school plant a memorial tree, to be intrusted to its care, to awaken thus an interest in objects of this kind at an early age?

Reverting to the importance of shelter, let me remark that fifty years ago the Peach flourished in North Pennsylvania, in Ohio and New York, where it cannot any longer now be grown, in consequence of the now colder and far more changeable climate, after the forests became extensively removed. Even ordinary orchards and cereal fields suffer there now. Yet, poor land will yield a better return in wood than in corn crops, and it is not too much to say that the favorable effect of a young forest on climate may be felt already, after a dozen years. Even on ordinary sheep-runs, trees are of the greatest importance, both for shelter and shade.

Having endeavored to explain forest value as it presents itself in its primary aspects—namely, in reference to its importance to Nature's great economy, and in reference to its timber resources, as viewed in the abstract—I now proceed to enter on a new field of consideration, which, though secondary in importance, is well deserving of our calm attention; and this all the more since this field of industrial enterprise remained yet almost bare or unharvested, whereas any utilization of this new ground must have, to inquiring minds, more than ordinary charm.

I therefore now proceed to explain some of the technologic features of woodlands.

A leading industry in all forests is the production

of charcoal. It may be made in mounds, caverns, or ovens. The method most frequently adopted is that in mounds or meilers, and to this I may devote a few explanatory words, as not every one in this hall may be conversant with the process; for, simple as the process does appear, it is, after all, not performable without some skill, if coal of a superior quality is to be the result. The wood is closely packed around a central post in regular form, the pieces either all horizontally, or, oftener, the lower vertically. Only such wood should be used as is unfit for timber; it must, however, be of one kind only, or of such various sorts as require the same degree of heat for being converted into a perfect coal. It must be sound and almost air-dry. A loamy sand-soil forms the best base for a mound; and this soil requires to be broken up, leveled and pressed, also dried by branchlets being burnt on the ground. The form of the mound or meiler is usually hemispherical, and support is given to this mound in the manner indicated in the sketch here presented, the outer support consisting of short logs of wood.

The inner part of the cover is formed of sods of grass, branchlets, rushes, and similar substances; over this is placed the outer portion of the cover, consisting of moist forest-soil, particularly fresh humus. The united covering must permit the vapors of the glowing meiler to escape. Shelter against wind is absolutely requisite; the operation of burning coal can therefore be well performed only in still air. The ignition commences from an opening left purposely, either at the base or, less frequently, at the summit of the structure, but either opening is closed again

during the burning process. Caution is needed to prevent the expansive vapors and gases causing explosions during the glowing of the wood. To promote combustion on places where it may have been suppressed, holes are forced through the covering on the second or third day, particularly on the lee side.

A bursting forth of gases of a blueish hue indicates active burning, and under such circumstances the access given to the air must be closed, while new perforations are made in any yet inactive portion of the meiler.

Over-great activity of fire is suppressed by water applied to the covering, or by adding to the thickness of the latter. Strong sinking of the cover during the earlier burning proves more or less complete combustion of the coal, and it may then become necessary to refill hurriedly the holes with wood or coal, under-closure of all openings, and careful restoration of the cover thus temporarily removed on one spot. This refilling in large meilers may be required for five days in succession; but the more carefully the mound has been built, and the more watchfully the early glowing process has been conducted, the less necessity will arise for the troublesome and wasteful process of refilling. A final additional covering becomes frequently needful. The operation closes by the sinking of the cover, or by its being partially forced downward, and the ready coals are removable one day afterward. Partial withdrawals of coal can be effected from the lee side while the meiler is still active.

The specific gravity of charcoal stands generally in a precise proportion to the specific weight of the wood employed. Dryer wood realizes a heavier, moister

wood a lighter coal. Slow combustion also renders the coal heavier than a more rapid burning process, because in the latter case more carbon is consumed for various volatile products formed from the wood. As a rule, the quantity of coal obtained is about a quarter of the weight of wood employed. Good coal has a slight metallic lustre, is firm, not friable, causing a clear sound when thrown on the ground. It must burn without flame and smoke. For trade purposes coal must be kept dry, as its absorption of humidity is considerable.* The heating power of coal as compared to wood is ascertained to be as one hundred to fifty-five or sixty. An equal volumen of wood produces less heating effect than the same space of coal. For technic operations the equable and more lasting heat, and the great power of radiation, give to charcoal its special value. Igniting wood for charcoal in caverns is wasteful, through the great access of air.

By the method of carbonizing wood in ovens, tar and other volatile products can be secured. The wood chosen for coal intended for gunpowder is chiefly that of Willows, Poplars, Alder, and Lime. It must be healthy, and is preferred from young trees. Woods which contain a good deal of hygroscopic salts—such as that of Elms, Firs, Oaks—are not adapted for the purpose. Extreme degrees of heat in producing coal for gunpowder or blasting powder should be avoided, otherwise the best wood will not serve the purpose, because the powder would be less ready to ignite. The yield of this coal is sixteen to seventeen one

*For extensive details consult von Berg's *Anleitung zum Verkohlen*; also, Muspratt's *Chemistry*.

hundredths from the wood. Local powder-mills are sure to be established here, especially as sulphur is readily obtainable from New Zealand. The increase of manufactures is also certain to augment the demand for wood and coal hereafter. For many industrial purposes charcoal is far preferable to fossil coal. Coals from various kinds of Victorian wood are placed before you.

It was my intention, while explaining the industrial resources of the forest, to show also how tar, vinegar and spirits might be obtained by heating wood in close vessels, at a temperature of three hundred to three hundred and fifty centigr., under a process called dry distillation. But I must reserve this subject for another occasion; for, however simple the procedure may be regarded, as far as the actual performance of this artisan's work is concerned, yet the chemie processes, which are active in this form of decomposition, are of the greatest complexity; they present, moreover, according to the wood employed and according to the degree of heat applied, some peculiarities, which as yet have not been fully investigated, holding out hope for the discovery of some new dyes and other educts. It will be scarcely credited by most of this audience that the paraffin, which now largely enters into the material for the candles of our households, is not only obtainable from bituminous slates, turf and fossil coal, but is also produced by the heating of wood under exclusion of air. This substance is furthermore a hydrocarbon of great purity; and its cheap preparation, along with other substances from our native wood, may possibly become a local source of immense wealth. For obtaining information on the

products from heated wood, and the various apparatus employed in dry distillation, reference may be made to the great work, *Chemistry Applied to Arts and Manufactures*, by Professor Muspratt, a man of genius and industry, whose death within the last few months we had so deeply to deplore.

Presented to you here are samples of tar, acetic acid, and alcohol, from several of our more common woods ; also pieces of pine-wood, coated with eucalyptus tar, the black color, with its fine lustre, have remained unimpaired for a series of years. Our wood-tar would, for many industrial purposes, be equal in value to the best kinds of other tar, and may prove, in some respects, superior to them.

Among the undeveloped wood-resources we must not pass that referring to potash, particularly as this alkali can be obtained without sacrifice of any valuable timber, and from localities not accessible to the wood trade.

For the preparation of potash, the wood, bark, branches, and foliage are burnt in pits sunk three or four feet in the ground ; the incineration is continued till the pit is almost filled with ashes. Young branches and leaves are usually much richer in potash than the stem-wood ; hence they should not be rejected. The ashes thus obtained are placed, in tubs or casks, on straw, over a false bottom.

Cold water, in moderate quantities, is poured over the ash, and the first strong potash-liquid removed for evaporation in flat iron vessels, while the weaker fluid is used for the lixiviation of fresh ashes.

While the evaporation proceeds, fresh portions of strong liquid are added until the concentrated boiling fluid assumes a rather thick consistence,

At last, with mild heat and final constant stirring, the whole is evaporated to dryness. This dry mass represents crude potash more or less impure, according to the nature of the wood employed.

A final heating in rough furnaces is needed, to expel sulphur combinations, water, and empyreumatic substances; also, to decompose coloring principles. Thus pearlash is obtained.

Pure carbonate of potassa in crude potash varies from forty to eighty per cent. Experiments, as far as they were instituted in my laboratory, have given the following approximate result with respect to the contents of potash in some of our most common trees. The wood of our She-oaks (*Casuarina suberosa* and *Casuarina quadrivalvis*), as well as that of the Black or Silver Wattle (*Acacia decurrens*), is somewhat richer than wood of the British Oak, but far richer than the ordinary Pine woods.

The stems of the Victorian Blue Gum-tree (*Eucalyptus globulus*), and the so-called swamp Tea-tree (*Melaleuca ericifolia*), yield about as much Potash as European Beech.

The foliage of the Blue Gum-tree proved particularly rich in this alkali; and as it is heavy and easily collected at the saw-mills, it might be turned there to auxiliary profitable account, and, indeed, in many other spots of the ranges.

A ton of the fresh leaves and branches yielded, in two analyses, four and three quarters pounds of pure potash, equal to about double the quantity of the average kinds of pearlash. The three species of *Eucalypts* spontaneously occurring close around Melbourne—the Red Gum-tree (*Eucalyptus rostrata*); the Man-

na Gum-tree (*Eucalyptus viminalis*) ; the Box Gum-tree (*Eucalyptus melliodora*) produced nearly three pounds of pure potash, or about five pounds of pearl-ash from a ton of fresh leaves and branches ; while a ton of the wood of the Red Gum-tree, in a dried state, gave nearly two pounds weight of pure carbonate of potassa, whereas the wood of the Blue Gum-tree proved still richer. A ton of the dry wood of the erect She-oak (*Casuarina suberosa*) furnished the large quantity of six and one half pounds of pure potash. This result is about equal to that obtainable from the European Lime-tree or Linden-tree, which again is one of the richest of all European trees in this respect.

Such indications may suffice to draw more fully the attention of forest settlers to an important but as yet latent branch of industry. For further details I refer to elaborate tables of the yield of potash in native trees, as the result from analyses made under my direction by Mr. Chr. Hoffmann — these tabulated statements being appended to my departmental report, presented to Parliament in 1869. The wholesale price of the best pearl-ash is about £3 for the cwt. in Melbourne.

I wish it distinctly to be understood that I do not advocate an indiscriminate sacrifice of our forest-trees for any solitary one of its products, such as the pot-ash ; because by any such procedure we would still more accelerate the reduction of our woods. On the contrary, good timber, fit for splitting or for the saw-mill, ought to be far too precious for potash or tar preparation. But branch-wood, bark, roots, crooked stems, and even foliage, might well be utilized for this industry, wherever the place is too remote to dis-

pose of this material for fuel. The recommendation carries with it still more weight, if we remember how on many places the close growth of suckers or seedlings has to be thinned to allow of space for the new and unimpaired upgrowth of actual timber; whereas, moreover, now the remnants at places where trees have been felled, often block by impenetrable barricades the accessible lines of traffic through the forests, and are frequently the cause of the extensive conflagrations of the woods, by placing so much combustible, dry, and mostly oily material within the easy reach of the current of flames. Should, unfortunately, the fiery element have anywhere swept through the forest, it may then prove advantageous to collect the fresh ashes before they are soaked by rain, with the object of extracting thus large quantities of potash. The whole process of potash preparation being one of the simplest kind, and involving only a very trifling expense in casks and boiling-pans, can be carried out anywhere as a by-work, the profit thus being not reduced by skilled or heavy labor or by costly plant. The demand for potash must always be considerable, as it is required for the factories of niter (particularly from soda saltpeter), one of the three principal ingredients of gunpowder and blasting-powder; it is needed also for glass, alum, various kinds of soaps, dyes, and many chemicals.*

Potash, although universally distributed, is best obtained in the manner indicated. I may remark, however, though deviating from my subject, that it is one of the most potent constituents in all manures,

* Flint-glass contains about a fifth pure pearlash; crown-glass, the best window-glass, rather more than a quarter. Some potash-niter is wanted also in either case.

being especially needed in the soil for all kinds of root-crops, for vine and maize ; nor can most other plants live without it altogether, although the quantity required may be small ; but I must add, for manuring, potash by itself would be far too valuable.

Almost every kind of forage affords potash salts, these being among the necessities for the support of herbivorous animals. Their undue diminution in food is the cause of various diseases, both in the animal and vegetable world ; or predisposes, by abnormal chemic components of the organisms, to disease.

The muscles of the human structure require a comparatively large proportion of carbonate of potassa ; it is also absolutely required in blood, predominating in the red corpuscles. Plants grown in soil of rocks containing much feldspar—such as granite, gneiss, syenite, some porphyries, diorite—are always particularly productive in potash, potassium entering largely into felspathic compounds. The latter mineral yields, in most cases, from twelve to fourteen per cent. of potassa, which, if changed to carbonate, would become augmented by nearly one half more. It is fixed chiefly to silicic acid in feldspar, and thus only tardily set free through disintegration, partly by the chemic action of air, water, and various salts, partly through the mechanic force of vegetation.* The importation of potash into Victoria during 1870 was only one hundred and seventy tons, but, with the increase of chemic factories, we shall require much more.

It has justly been argued that the chemic analysis affords a very unsafe guidance to the artisan, as regards the quantity of potash obtainable from any kind

* The proverb of chemistry — “ *Corpora non agunt, nisi fluida* ” — is here also applicable.

of tree or other plant, inasmuch as necessarily the percentage must fluctuate according to the nature of the soil, this, again, depending on geologic structure and the quality and quantity of decaying foliage on any particular spot. It should, however, not be quite forgotten that most plants have a predilection for that soil which contains, in regions otherwise favorable to them, also due proportions of such mineral particles as are essentially necessary for the normal nutrition of the peculiar species; for, otherwise, in the wild combat for space it would succumb or cede before the more legitimate occupant of such soil. Hence, at a glance, even from long distances, we may recognize in many of our forest regions an almost abrupt line of demarcation between the gregarious trees, where one geologic formation meets or replaces the other. Thus, trees richer in potash, or oils, or any other product, may often be traced with ease over their geologic area, for which purpose the admirable maps of Mr. Selwyn and his collaborators afford us here in Victoria also in this respect already so very much facility.

I have often been led to think that many an indigent person might find employment by collecting the wood-ashes, which, as a powerful manure, or as material for a local potash-factory, ought to realize a fair price. Such an employment would be probably as lucrative as collecting glass, or bones, or substances for paper-mills, while the ashes, now largely wasted, would be fully utilized.

It may be assumed that, at an average, the ash of our ordinary Eucalypts contains ten per cent. of crude potash, equal to about five per cent. pure potash. A

bucketful of wood-ash, such as we daily remove from our domestic fire-places, contains about twenty-five pounds, from which, accordingly, about two and one half pounds of inferior, or one and one fourth pounds of superior potash, may be obtained; the former being worth about sixpence per pound, the latter double the price. For ascertaining the contents of carbonate of potassa in crude potash or pearlash, certain instruments, well known as alkali-meters, are constructed. The heaviest ashes, as a rule, contain the greatest proportion of potash. The brake-fern, so common on many river-banks and sandy tracts of the country, is rich in this alkali.

Apart from my subject, I may, however, say that there are other sources of potash-salts than trees alone. Chloride of potassium is obtained from some large salt-beds, for instance, in Prussia. From this source it was supplied to British manufactories, in 1869, to the extent of one hundred and fifty-four thousand four hundred and sixty-eight hundred weight, valued at above £60,000. This chloride is besides obtained, under Mons. Balard's process (Report of Juries at the International Exhibition for 1862), in considerable quantities from sea-water, as one of the contents to be utilized. From this chloride the various potash salts, otherwise largely obtained from pearlash, can be also prepared. Chlorides and sulphates, if they occur in crude potash, can, in the process of purification, almost completely be removed through crystallization from the greatly concentrated solution.

Let us now approach another forest industry, one quite unique and peculiar to Australia—namely, the distillation of volatile oil from Eucalyptus and allied

Myrtaceous trees. While charcoal, tar, wood-vinegar, wood-spirit, tannic substances and potash, are obtainable and obtained from the woods of any country, we have in Australia a resource of our own in the Eucalyptus oil. In no other part of the globe do we find the Myrtaceæ to prevail; in Europe it is only the *Myrtus* of the ancients, the beautiful bush for bridal wreaths, which there represents this particular family of plants; and although copious species of *Eugenia* and other berry-bearing genera, including the aromatic clove and allspice, are scattered through the warmer regions of Asia, Africa, and America, all pervaded by essential oil, they do not constitute the main bulk of any forests as here, nor can their oil in chemic or technic properties be compared to that of the almost exclusively Australian Eucalyptus. This special industry of ours exemplifies also, in a manner quite remarkable, how from apparently insignificant experiments may arise results far beyond original anticipations. When, in 1854, as one of the commissioners for the Victorian Industrial Exhibition, held in anticipation of the first Paris Exhibition, I induced my friend, Mr. Joseph Bosisto, J. P., to distil the oil of one of our Eucalypts, I merely wished to show that this particular oil might be substituted for the comparatively costly oil of cajuput, obtained in some parts of India, and rather extensively used in some countries for medical purposes. For the exhibition of 1862 about thirty different oils were prepared by the same gentleman, chiefly from various Eucalypts, and from material mostly selected by myself for the purpose. This led not merely to determining the percentage of yield, but also to extensive experi-

ments, here chiefly by Messrs. Bosisto and Osborne, and in London by Dr. Gladstone, in reference to the illuminating power, the solvent properties, and other special qualities of each of these oils. The principal results of these experiments were recorded in reports of the exhibition jurors at the time. Mr. Bosisto, with great sagacity and a commendable perseverance, but also at first with much sacrifice of capital, carried his researches so far as to give to them great utilitarian value and mercantile dimensions; moreover, he patented a process by which he was enabled to derive from the eucalyptus foliage the greatest amount of the purest essential oil with the least consumption of fuel and application of labor. Under this process it became possible to produce the oil at a price so cheap as to allow the article to be used in various branches of art—for instance, in the manufacture of scented soap, it having been ascertained that this oil surpassed any other in value for diluting the oils of roses, of orange flowers, and other very costly oils, for which purposes it proved far more valuable than the oil of rosemary and other ethereal oils hitherto used. Suddenly, then, such a demand arose that our thoughtful and enterprising fellow-citizen could export already about nine thousand pounds to England and three thousand pounds to foreign ports, though even now this oil is as yet but very imperfectly known abroad. The average quantity now produced at his establishment, for export, is seven hundred pounds per month. Alcoholic extracts of the febrifugal foliage of *Eucalyptus globulus* and *Eucalyptus amygdalina* have also been exported in quantity by the same gentleman to England, Germany, and America.

Similar substances from various melaleucas might be added. Originally, an opinion was entertained that all the eucalyptus oils have great resemblance to each other; such, however, proved not to be the case when it came to accurate experimental tests. Thus, for instance, the oil which in such rich percentage is obtained from *Eucalyptus amygdalina*, though excellent for diluting the most delicate essential oils, is of far less value as a solvent for resins in the fabrication of select varnishes. For this latter purpose the oil of one of the dwarf Eucalypts forming the Mallee Scrub, a species to which I gave, on account of its abundance of oil, the name "*Eucalyptus oleosa*" nearly a quarter of a century ago, proved far the best. It is this Mallee oil which now is coming into extensive adaptations for dissolving amber, Kauri resin, and various kinds of copal. Mr. Bosisto's researches are recorded in the volume of the Royal Society of Victoria for 1863; Mr. Osborne's in the Jurors' Reports of the Exhibition of 1862. For alluding so far to this oil distillation I have a special object in view. I wish to see it adopted near and far as a collateral forest industry, now that the way for the ready sale of this product is so far paved. The patentee is willing to license any person to adopt his process, and he is also ready to purchase the oil at a price which will prove remunerative to the producer. If it is now considered how inexhaustible a material for this oil industry is everywhere accessible in our ranges, how readily it is obtainable, particularly at saw-mills and at splitters' establishments, and how easily the process of the distillation can be performed, it would be really surprising should these facilities not be seized

upon, and should under such favorable circumstances not a far larger export of this mercantile commodity be called forth. Those Eucalypts are the most productive of oil in their foliage which have the largest number of pellucid dots in their leaves; this is easily ascertained by viewing the leaves by transmitted light, when the transparent oil-glands will become apparent, even without the use of a magnifying lens. Mr. Bosisto is also a purchaser of scented flowers, indigenous as well as cultivated, including even the wattle flowers, for the extraction of delicate scents, under a clever process discovered by himself; and it is astonishing what an enormous demand for these perfumes exists in European markets. This may be a hint to any one living in or near the forests, where the extraction of the scent could be locally accomplished from unlimited resources, with little trouble and cost.

There exists another special industry in its incipient state among us, which might be regarded as essentially Australian, and which also might be widely extended: I mean the gathering of seeds of many kinds of Eucalyptus, and also of some Acacias and Casuarinas, for commercial export. No doubt the collecting of seeds is effected among the forest-trees of any country, and very important branches of industry these gatherings are, in very many localities abroad. But what gives to our own export trade of forest seeds such significance is the fact that we offer thereby means of raising woods with far more celerity and ease than would be possible through dissemination of trees from any other part of the globe, it being understood that the operations are instituted in climatic

zones similar to our own. Trees with softer kinds of woods, such as Poplars and Willows, even though they may rival some of the Eucalypts in quickness of growth, cannot be well drawn into comparison, as most of them do not live in dry soil, nor attain longevity, nor assume gigantic dimensions, nor furnish timber of durability. But there are still other reasons which have drawn our Eucalypts into extensive cultural use elsewhere—for instance, in Algeria, Spain, Portugal, Italy, the south of France, Greece, Egypt, Palestine, various uplands of India, the savannahs of North America, the llanas of South America, at Natal and other places in South Africa, and even as near as New Zealand.* One of the advantages offered is the extraordinary facility and quickness with which the seeds are raised, scarcely any care being requisite in nursery works; a seedling, moreover, being within a year, or even less time, fit for final transplantation. Another advantage consists in the ease with which the transit can be effected, in consequence of the minuteness of most kinds of Eucalyptus seeds,† there being, besides, no difficulty in packing on account of the natural dryness of these seeds. For curiosity's sake I had an ounce of the seed of several species counted, with the following results:—

Blue Gum-tree, one ounce—sifted fertile seed grains	10,112
Stringy-bark tree (unsifted)	21,080
Swamp Gum-tree (unsifted)	23,264
Peppermint Eucalypt (unsifted).	17,600

* The seeds of *Eucalyptus rostrata* (our Red Gum-tree) are available for all tropic countries, inasmuch as this species, which is almost incomparably valuable for its lasting wood, ranges naturally right through the hot zone of Australia.

† The seeds of the West Australian Red Gum-tree (*Eucalyptus calophylla*) and the East Australian Bloodwood-tree (*Eucalyptus corymbosa*) are comparatively large and heavy.

According to this calculation we could raise from one pound of seeds of the Blue Gum-tree one hundred and sixty-one thousand seven hundred and ninety-two plants. Let us suppose, for argument's sake, that only half the seeds of such grew, the number of seedlings would be enormous; and even if only the seedlings of one quarter of the seeds of one pound finally were established, they would suffice, in the instance of the Blue Gum-tree, to cover four hundred and four acres, assuming that we planted at the rate of one hundred trees to the acre (allowing for thinning out). The following notes, for comparison, may be of interest:

One ounce of:	Contains Grains.
<i>Pinus pinaster</i>	730
<i>Pinus pinea</i>	38
<i>Pinus halepensis</i>	940
<i>Pinus alba</i>	10,080
<i>Cupressus sempervirens</i>	4,970
<i>Fraxinus ornus</i>	316
<i>Betula alba</i>	34,560
<i>Acer pseudoplatanus</i>	183

It seems marvellous that trees of such colossal dimensions, counting among the most gigantic of the globe, should arise from a seed-grain so extremely minute.

The exportation of Eucalyptus-seeds has already assumed some magnitude. Our monthly mails conveyed occasionally quantities to the value of over £100; the total export during the past twelve years must have reached several or, perhaps, many thousand pounds sterling. For the initiation of this new resource, by his extensive correspondence abroad, the writer can lay much claim; and he believes that almost any quantity of Eucalyptus-seeds could be sold in markets

of London, Paris, Calcutta, San Francisco, Buenos Ayres, Valparaiso and elsewhere, as it will be long before a sufficient local supply can be secured abroad from cultivated trees.

Monsieur Prosper Ramel, of Paris, stands foremost among those who promoted Eucalyptus culture in South Europe.

Facts, such as just alluded to, may give an idea with what ease the Eucalyptus can be disseminated over extensive areas. Although the first cost of seeds, or the facilities for their transit, preservation, and germination, can only enter to a small extent into consideration, when an object so important as that of raising or restoring forests is to be attained, yet the data thus far given in reference to some of the best Eucalypts cannot but tend toward encouragement of culture here and abroad. Indeed, among nearly all the trees of the globe, most of our Eucalypts, together with species of the allied genera — *tristania*, *angophora*, *melaleuca* and *metrosideros* — produce seeds the most minute and the most copious. The seeds of the Birches, and of most species of *ficus* are, however, also remarkably light and numerous.

At saw-mills and splitters' establishments, the gathering of seeds, particularly through the aid of children, might be carried on most conveniently and most inexpensively, the sums realized therefrom being clear gain. The same may be said of collecting the abundant gum-resins of various Eucalypts, which, for medicinal and technologic purposes, are now in much demand for export. Purchasers in the city offer about one shilling per pound. The liquid (very astringent) exudations of the Eucalypts are also salable. The

precise quantity of tannic substance to be obtained from saplings and foliage of various Eucalypts, acaciæ and casuarinæ remains yet unascertained ; but it is likely large enough to base on their yield of tannic acid special forest industries.

For belts of shelter-plantations, again, no country in the warm temperate or subtropic zone could choose trees of easier growth, greater resistance, rapidity of increment, early and copious seeding, contentedness with poor soil, and yet valuable wood for various purposes, than some of the Australian acaciæ and casuarinæ. They exceed much in quickness of growth the coast shelter-pines of South Europe, *Pinus halepensis* and *Pinus pinaster*, but are not all equally lasting. The trade in seeds of this kind is also not unimportant, and the sources of it are, at least partly, in our sylvan land.

Still another forest industry might be viewed as especially Australian, namely, the supply of Fern-trees for commercial exportation. Though about one hundred and fifty kinds of Fern-trees are now known, they are mostly children of tropical or subtropical countries, and these, again, nearly all restricted to the humid jungles or the shady valleys meandered by forest brooks. Very few species of these noble plants extend to a zone so cool as that of Victoria, Tasmania, and New Zealand. Again, among this very limited number, the stout and large *Dicksonia antarctica* is not only one of the tallest of all the Fern-trees of the globe, but certainly also the most hardy, and the one which best of all endures a transit through great distances. Indeed, a fresh, frondless stem, even if weighing nearly half a ton, requires only to be placed,

without any packing, in the hold of a vessel as ordinary goods, to secure the safe arrival in Europe,* the vitality being fully thus retained for several months, particularly if the stem is occasionally moistened, and kept free from the attacks of any animals. Through my unaided exertions these hardy Fern-trees became, like many other of our resources, fully known in many countries; and, while their value became established, a market for them has now been gained. I would, however, not countenance the vandalism of denuding every one of our Fern-glens of its pride, as, even with all care, in half a century the pristine grandeur of the scenery could not be restored; yet, when we consider that hundreds of gullies are teeming with these magnificent plants, we can well afford to render them accessible also to all the conservatories of the winterly north, in order that the inhabitants there may indulge in admiration of such superb forms of vegetable life, even though a Fern-tree group in a glass house can convey but a very inadequate idea of the wild splendor of our Fern ravines. Not without pain I have seen constructed the base of whole tramway lines in some of our forest-gullies, almost exclusively of Fern-trees, for the conveyance of timber. A watchful Forest Board would prevent such sacrifice, and would save also the tall Palm-trees of East Gipps Land from sharing the fate of those princely trees at Illawarra and elsewhere. [Since writing this, our Livistonas or Fan-palms have been protected by Government interdiction; the law forbids also the indiscriminate removal of Red Gum-trees from the banks of the Murray River. In Queensland, every bunya-

* No Fern-tree is indigenous to Europe.

bunya tree and native nut-tree is secured against being felled. The very local and circumscribed Kauri forests, known only in two limited spots, would also need some protection.] To the facilities of exporting the huge, square Todea Ferns—a commerce initiated by myself—I alluded on a former occasion.

Having dwelt on some of the technologic or mercantile products obtainable from the native forests—few, it is true—I now pass on to some brief observations in reference to enriching the resources of our woods.

Among new industries which, by introduction from abroad, are likely to be pursued in sylvan localities, that of the cultivation of the Tea shrub of China and Assam stands, perhaps, foremost. It is a singular fact that even in the genial clime of Southern Europe, and under advantages of inexpensive labor, the important and lucrative branch of Tea-culture has received as yet no attention whatever. This is probably owing to the circumstance that hitherto the laborious manual process of curling the fresh Tea-leaves under moderate heat has never yet been superseded by adopting for the purpose rollers worked and heated by steam, though such contrivance was suggested here by me many years ago.

The tea thus obtained could always be brought to its best aroma by such a mode of exact control over the degree and duration of the heat. Tea-culture in the ranges would show us which soil, or which geologic formation, produced here the best leaves. The yield of the latter would, in the equable air of the humid air of the forest-glens, be far more copious than

the harvests which we obtain from the tea-bushes planted in poor soil or exposed localities near the metropolis, while localities in the ranges are often not accessible to ordinary cereal culture. But I do not speak of Tea cultivation as an ordinary field industry, but rather as a collateral occupation in forest-culture of the lower ranges.

Foreseeing the likelihood that this branch of rural culture would be adopted in many favorable warm spots of this colony, I have distributed, during the past dozen years, the Tea - bush rather extensively among country residents, partly with the view of directing attention to a plant which, even for the sake of ornamental value, is so eligible and easily grown ; partly with an intention of seeing thus independent local supplies of seed forthcoming. In the same way the Cork Oak was very generally distributed by myself, in order that their acorns might, in due time, become locally accessible in very many places.

The tea, in its commercial form, will however, here, not likely be manufactured by the grower. It is more probable that whenever plantations are formed in any forest region, an enterprising man will establish amidst the tea-farms a factory for preparing the tea-leaves, and purchase the latter from the producers. This is the system by which, in many parts of South Europe, the multitude of small lots of silkcocoons pass into the central reeling establishments ; and this is the manner in which, from numerous peasants, the beet-root is obtained for the supply of sugar factories. In the same way the branches of the Sumach, a shrub which, with care, could be reared in

our ranges, would be rendered saleable at a central sumach mill.* The demand for tea being so enormous, and geographic latitudes like ours being those which allow of its growth, it will be fully apparent that it must assume a prominent part in our future rural economy, particularly as the return for capital and labor thus invested and expended will be quite as early as that from the vine. The importation of tea into Victoria, during 1870, has been valued in the customs returns at £496,623; whereas Victoria might largely export this highly important and remunerative commodity.

The simple process of gathering the leaves might be performed by children.

In the foregoing pages I alluded cursorily to the Cork Oak; let me add my opinion, that in any locality with natural boundaries, such as abrupt sides of ranges, deep water-courses, where fences could be largely obviated, the Cork-tree might well be planted as a forest-tree, and thus estates be established at little cost, with hardly any expense of maintenance, from which a periodic yield of cork might be obtained for several successive generations. The investment of a limited capital for raising a cork-forest in any naturally-defined locality would, as I said, create a rich possession for bequest. Even if by new inventions an artificial substitute for cork was found, the wood of the Cork Oak would still be of some value. The State might also reserve any forest area with natural boundaries for its various wood requirements.

*An essay by Professor Inzenga, on Sumach-culture in Sicily, translated by Colonel H. Yule, C. B., is published in the Transactions of the Botanic Society of Edinburgh, vol. ix., 341-355, and was, on my suggestion, transferred to a local journal,

Many other cultural resources of forests are as yet very inadequately recognized. The dye-saffron might be grown as much for amusement as for the sake of its pretty flowers, just as an ordinary bulb, wherever juvenile gatherers can be had. Equally lucrative might be made the culture of another plant, the medicinal colchicum, a gay Autumnal flowering bulb worthy of a place in any garden. In apt forest spots both would become naturalized. Amidst the forests, in the glens which skirt the very base of alpine mountains, on the M'Allister River, opium was produced without any toil, almost as a play-work, to the value of £30, from an acre. Mr. Bosisto, who, on that particular locality, called forth this industry, found on analysis that the Gipps Land opium proved one of the most powerful on record, ten one hundredths of morphia being its yield. Small samples of opium prepared in the Melbourne Botanic Garden were exhibited some years ago at the International Exhibition. The Hon. John Hood, of this city, promoted much the opium industry in this country by the extensive distribution of seeds of the Smyrna poppy; he found the yield here, in favorable seasons and by careful operation, to be from forty to fifty pounds on an acre, worth at present thirty to thirty-five shillings per pound. The value of the opium imported into Victoria during 1870, according to customs returns, was £150,681. The banks of many a forest brook, and the slopes within reach of irrigation from springs, might, doubtless, in numerous instances, be converted into profitable hop-fields, the yield of hops in Gipps Land having proved very rich. Mr. A. M. M'Leod obtained, in one instance, fifteen hundred pounds of hops from an acre of ground at Bairnsdale.

Messrs. A. W. Howitt, F. Webb, and D. Ballentine had there also large returns from their hop-fields. As an instance how large a revenue might be realized from forest land in various ways, quite irrespective of wood supply, I adduce the fact that the income obtained by the Forest Department of Hanover from the mere gathering of fruit—chiefly bleeberries—amounted to £21,750 during one of the late years. The Hanoverian forests comprise an area equal to the county of Bourke, our metropolitan county, and occupy one seventh of the territory. Speaking of Hanover, let me add, that the laws promulgated this year in that country render it compulsory on each district to line its roads with trees, the widest distance allowed from tree to tree being thirty feet; similar laws were in force long since in other parts of Germany; fruit-trees are among the trees chosen for these lines. Would it not therefore be advisable to naturalize along our forest brooks and in our shady vales such plants as the raspberry-bush, strawberry-plant, and others, which readily establish themselves? In one of my exploring tours, when it fell to my lot to discover the remotest sources and tributaries of the River Yarra, and to ascend first of all Mount Baw Baw, I scattered the seeds of the large-fruited Canada blackberry along the alpine springs; and I have since learned that this delicious fruit is now established on the rivulets of that mountain. We may hear of equal successes of experiments which I elsewhere instituted. The truffle, though not an article of necessity, might be naturalized in many of our forests, especially in soil somewhat calcareous. Would any one imagine that during one recent year (1867) the quantity collected in France was valued at £1,-

400,000 (35,000,000 francs) ? The time allotted to my address is not sufficient to add much to these instances.

On various occasions I drew attention to the likelihood of Peru-bark plants being eligible for culture in the sheltered and warmer parts of our woods, inasmuch as in brush shades of the Botanic Gardens the cinchonæ endured a temperature two or three degrees under the freezing point. Last year Cinchona-plants given by me to Mr. G. W. Robinson, of Hillesley, near Berwick, for experiment, passed quite well through the cool season without any cover. The lowest temperature at Harmony Valley, Blackwood Gully, in the Dandenong Ranges, observed during 1866 by Mr. Jabez Richardson, who, on my request, kindly undertook the thermometer readings there during that year, was still one degree above the freezing point, while the temperature at the Melbourne Observatory sunk to twenty-eight degrees Fahrenheit. Let me note, however, that simultaneously frost occurred in the open flats of Dandenong ; hence the great importance of forest shelter in cases like this. East Gipps Land, with its mild temperature, is likely to prove the aptest part of the Victorian colony for Peru-bark cultivation. Who does not remember the deep grief into which a small insular colony sunk within the last few years, when its population became actually decimated by fever, and when, after one hundred and fifty years of existence of that unhappy colony, only just the first Cinchonas had been planted.

In some of the uplands of New South Wales, where it was desirable to clear away bush vegetation—such, for instance, in which *Daviesias*, or native hop, pre-

dominated — angoras proved very effectual for the purpose. Doubtless there are many forest tracts where this measure could be adopted with advantage to gain grass pasture, without any injury being done to large native trees; but the smaller trees are likely to suffer, while the underwood might in many instances be better utilized for potash or oil. At all events, goats are, among pastoral animals, the most destructive to vegetation, and much of the forests on the Alps of Switzerland and Tyrol were destroyed by the indiscriminate access given to goats. The Angora, with its precious fleece, can therefore be located only in some forest regions; it thrives, moreover, in the desert.

I might allude, on this occasion, also to the great productiveness of bees in our forests, the flowers of so many of our native plants, and among them those of the Eucalypts, being melluginous—blossoms of some kind or the other being available all the year round. Cuba, with an area less than half that of Victoria, exported, in the year 1849, so large a quantity of honey as two millions and eight hundred thousand pounds, and about one million pounds of wax. I believe the export has since increased. A forest inhabitant might devote a plot of ground near his dwelling to the earth-nut or pea-nut, an originally Brazilian plant, of which latterly about nine hundred thousand bushels were produced annually in the United States for the sake of its excellent table-oil. In *Harper's Magazine* of 1870 it is stated that of the earth-nut, in 1869, not less than two hundred and thirty-five thousand bushels were brought to New York. It is estimated that Virginia, Tennessee, Georgia, and Carolina

have conjointly sent over one million bushels to market in 1870. The yield, it is said, is from eighty to one hundred and twenty bushels on an acre. The seeds are slightly roasted for the table, or pressed for a palatable oil. As much as ten shillings to twelve shillings is paid for the bushel in New York. The plant seems well eligible for forest-farms, particularly in a somewhat calcareous soil. In the garden under my control I have reared it with ease.

I intended to have spoken of the various implements especially designed for wood-culture; but time will not admit of it. Thus, merely by way of example, I place before you one of those utensils—the hohlborer, or, as it might be called, the “bore-spade”—brought into use nearly fifty years ago by a scientific forester, Dr. Heyer, of Giessen. Several thousand plants of the Scotch Fir and of other pines can be lifted with this bore-spade in a day by one forest laborer, the object being that each seedling should retain a small earth-ball, to facilitate the success of the moving process. About ten thousand such seedlings are conveyed at a time in a forest wagon.*

And yet, it must be confessed, our colony, with others in the Australian group, has accomplished but very little in any branch of sylvan maintenance, or forest culture, or the advance of industrial pursuits in our woodlands.

One precursory step, however, has been made, and this is likely to be followed. I allude to the extensive gratuitous distribution of plants to public grounds in most parts of our colony—a distribution which has been in operation under the authority of Government

* Since this lecture was delivered a short account of the bore-spade has appeared in the Melbourne *Economist*.

from ground under my control for the last twelve years. I should think it not unlikely that this raising of trees in masses will soon become also a special object of attention to the railway department, within its own areas, to re-supply its own wants.

While a divine may withdraw some of his slender means, or a teacher may devote a share of his scanty earning, to inclose the ground of his dwelling, with a view of protecting a few trees on spots not really their own, we may be sure that the authorities do not wish to see hundreds of miles of railway fences long left unutilized, so far as planting of trees is concerned, particularly as such fences for this purpose afford much ready inducement. The average width of the railway area is two and a half chains, both on the Ballarat and Echuca lines, therefore far wider than that of European lines, and spacious enough for tree plantations, at least of some kinds. The length of the N. E. Railway line will be one hundred and eighty-five miles, giving, consequently, three hundred and seventy miles' length for plantations. The slower-growing or less-lofty trees would there be on their place, such as our Red Gum-tree, the Iron-bark-tree, the W. A. Yarrah, the Blackwood-tree, the British Oak, the Quebec and Live Oak, the Cork Oak, the Elm, the Ash, the Totara, the Chestnut-tree, the Walnut, the Hickory, and many others which do not suffer from exposure; for while the railway loan will last for an indefinite period, the railway material, such as the fences, sleepers, cars, will not last forever, and for these the wood might thus inexpensively become re-available in due time. Even where the railway space is narrow the operation of lopping the

planted trees along its lines might most readily be resorted to, and dangerous encroachments thereby be avoided.

No one ever expected our most serviceable Railway Department to be burdened with the additional heavy task of entering on cultural pursuits, and I see no way of attaining the object here specially indicated unless purposely financial means and administrative organizations were provided by the State.

In a special work (*Die Bepflanzung der Eisenbahn Damme*, etc., by E. Lucas, second edition, 1870) the methods adopted in Germany for utilizing the railway dams, and the free space within railway fences, for wood and fruit culture, is amply discussed. With the increasing value of culture-land this question of utilizing the spare ground along railways becomes more and more important. Where the space proves too narrow for rearing timber-trees, Hazel, Olives, Figs, Mulberries, Almonds, Osiers, Sumach, Myall, Ricinus, Blackberries, and such other lower trees or bushes as require no great attention, could doubtless be grown with profit. It might also be possible to establish advantageously permanent hedges of Hawthorn, Opuntias, Osage Orange, and other not readily-inflammable and easily-managed bushes. Luzern and Sainfoin are much cultivated along continental railway-lines as fodder-herbs.

In North America six hundred and fifty Walnuts or Hickories are planted on an acre ; though standing so close, they are worth twelve shillings in twenty years for a variety of purposes. If wanted for heavy timber or nuts, they are thinned out so as to keep them twenty feet apart. This may serve as an indi-

cation how spare places on railways might be utilized. Our regular and quick communication with California is giving now easy opportunity for importing nuts of the various American Hickories and Walnut-trees in quantity ; while of the ordinary Persian Walnut-tree seeds can already be obtained both here and in Tasmania. Resinous Pine-trees may possibly increase any danger of conflagrations on railway-lines. Nurseries for sowing seeds of hardy utilitarian trees might at once be established on all the railway-stations at comparatively little cost.

The only effective public effort hitherto made to anticipate the necessities of forest culture consists in the planting of public reserves, parks, church-yards, school-grounds, cemeteries, and the area of many of our public buildings. The trading horticulturists have also largely aided in the importation and raising of foreign trees.

In this effort, as already remarked, I took a prominent share, or perhaps, in many instances, it originated from impulses or supports given by myself.

Undoubtedly, it was a primary object to cover the dismal barrenness of public grounds, to help in mitigating thereby local dryness and heat, to afford shade and shelter, and to render many a barren spot a pleasing retreat.

But this was not my only object. I had a second, and, to my mind, higher one in view.

I wished that, locally, many nuclei for forest culture should be formed ; that, within comparatively few years, seeds should almost everywhere become available in masses from local tree-plantations ; and that thus efforts now made for parks and pleasure-grounds

should be enlarged for creating more or less extensive forests.

These ideas may, perhaps, excite some surprise, yet I feel confident that they will and must be acted on before, in frightful truthfulness, the terrors of a woodless country in *our* zone, and settled with a future *dense* population, will be encountered.

Should, however, my warnings fail to impress the public mind, then at least I have placed my views on record, and should not be held responsible for interests, however vital, which the trust of my position must largely bring under my reflection and care.

My effort in supplying merely material for raising local plantations all over the colony is, however, but the first step in a great national work of progress; and I think we may reflect, not without some pride, that this public step was made in Australia here first of all.

Half a million of plants distributed by me to public institutions is, after all, but a trifle in a country that requires hundreds of millions of foreign trees, if it really is to advance to greatness and the highest prosperity; a greatness that will be retarded in the same degree as attention to this, one of its most urgent interests, is deferred.

The gifts of plants from the establishment under my control have provided the country with many a species that otherwise would not have existed here yet. Many of the magnificent or quick-growing Himalayan and California Pines, not to speak of others, became through my hand first dispersed by thousands and thousands; and although I may have incurred the displeasure of a few of the less thoughtful of my

fellow-citizens, who wished the slender means of my young establishments appropriated for the ephemeral glory of floral displays, and who wished to sacrifice lasting progress to unproductive gaiety, yet I feel assured that the fair feelings of the inhabitants of Victoria in general will approve of the path of predominant utility which I struck out for myself, and will respect the considerations which prompted me, in an equitable spirit toward town and country, to attend in the first instance to pressing necessities, leaving the unnecessary or less useful for the exertions of a later time.

If a census of the trees, which are to furnish us much seed for forest culture, could be held all over the colony, perhaps my early efforts would be viewed with more justice and gratitude.

" They did of solace treat,
And bathe in pleasure of the joyous shade,
Which shielded them against the broiling heat,
And with green bough decked the gloomy glade."

SPENSER.

In passing through a demolished forest, how saddening to us its aspect! What mind, capable of higher feelings, can suppress its sympathy, when we see stretched and withering on the ground a princely tree which but a few hours previously was an object of our admiration and a living monument of magnificence and glory. Do you think it had its enjoyment? Does it send mere automatically, without animation or sensibility of any kind, its crown to the sunny sky, or drink joyless the pearly dew? Do you think it closes its flowers but mechanically, or unfolds them again to imbibe light and genial warmth, absolutely without gladness or pleasure of any kind? What is

vitality, and what mortal will measure the share of delight enjoyed by any organism! Why should even the life of a plant be expended cruelly and wastefully, especially if, perhaps, this very plant stood already in youthful elegance, while yet the diprotodon (a wombat of the size of a buffalo) was roaming over the forest ridges encircling Port Phillip Bay—when those forest ridges on the very place of this city were still clothed in their full natal garb. Do not assume that I lean to transmutation doctrines; or that to my understanding there is an uninterrupted transit from the thoughts which inspire the mind to the faculties of animals and to the vitality of plants! Yet that individual life, whatever it may be, which we often so thoughtlessly and so ruthlessly destroy, but which we never can restore, should be respected. Is it not as if the sinking tree was speaking imploringly to us, and when falling wished to convey to us its sadness and its grief? Like the nomadic wanderer of the Australian soil passed away before us, so I fear most of the traces of our beautiful and evergreen forest will be lost ere long.

. . . "It is a goodly sight to see
 What heaven has done for this delicious land;
 What flowers of fragrance blush on every tree,
 What glad'ning prospects o'er the hills expand!
 But man would mar them with an impious hand."

BYRON.

Beyond the plain utilitarian purposes of our forests (some of which I endeavored briefly to explain), and beyond all, the important functions which the woods have to perform in the great economy of Nature, they possess still other claims on our consideration, such as ought to evoke some feeling of piety toward them.

It was in the forests where the poetic mind of Schiller, during his early boyhood,* first of all awoke to its deep love for nature ; where his strong sense for noble rectitude was formed ; where he framed his ideals of all that is elevated and great. This influence of nature we see reflected in other lofty minds ; it leads true genius on its luminous path. Contrast the magnificence of a dense forest, before the destructive hand of man defaced it, with the cheerless aspect of wide landscapes devoid of wooded scenery—only open plains or treeless ridges bounding the horizon. The silent grandeur and solitude of a virgin forest inspires us almost with awe —much more so than even the broad expanse of the ocean. It conveys, also, involuntarily to our mind a feeling as if we were brought more closely before the Divine Power by whom the worlds without end were created, and before whom the proudest human work must sink into utter insignificance. No settlement, however princely — no city, however great its splendor, brilliant its arts, or enchanting its pleasures — can arouse those sentiments of veneration which, among all the grand works of nature, an undisturbed noble forest-region is most apt to call forth. I never saw truly happier homes of unmingled contentedness than in the seclusion of the woods. It is as if the bracing pureness of the air, the remoteness from the outer world, the unrestricted freedom from formal restraint, give to forest-life a charm for which in vain we will ever seek elsewhere. The forest inhabitant, as a rule, sees his life prolonged ; an air of peace on all sides surrounds him ; even with less prosperity, he is glad to

* *Sketch of the Life of Schiller*, by Sir Edward Bulwer Lytton, p. 2.

break away from the turmoils and enmities into which elsewhere he is thrown by the bustle and struggle of the world, and to seek again this calm retreat in forest mountains. The existence of many an invalid might be prolonged and rendered more enjoyable, while many a sufferer might be restored to health, were he to seek timely the patriarchal simplicity of forest-life, and the pure air, wafted decarbonized in delicious freshness through the forest, ever invigorating strength, restoring exhilaration and buoyancy of his mind. In this young country new lines of railway are early to disclose some of the almost paradisiac features of sylvan scenery, hitherto known to most of us only through the talent of illustrious landscape-painters of this city.

“ To sit on rocks, to muse o'er flood and fell ;
 To slowly trace the forest's shady scene,
 Where things that own not man's dominion dwell,
 And mortal foot has ne'er or rarely been ;
 To climb the trackless mountain, all unseen,
 With the wild flock, that never need a fold ;
 Alone o'er steep and foaming falls to lean—
 This is not solitude : 'tis but to hold
 Converse with nature's charms, and view her stores untold.”

BYRON.

I regard the forest as an heritage given to us by Nature, not for spoil or to devastate, but to be wisely used, reverently honored, and carefully maintained. I regard the forests as a gift, intrusted to any of us only for transient care during a short space of time, to be surrendered to posterity again as an unimpaired property, with increased riches and augmented blessings to pass as a sacred patrimony from generation to generation.

ON THE
APPLICATION OF PHYTOLOGY
TO THE
INDUSTRIAL PURPOSES OF LIFE.

A POPULAR DISCOURSE,

Delivered at the Industrial Museum of Melbourne, on
3d November, 1870.

By Ferdinand von Mueller, C.M.G., M.D., Ph. D., F.R.S.

Comm. Ord., Santiago, Kn. of Orders of Austria, France, Prussia, Italy,
Wuerttemberg, Denmark, Mecklenburg, Gotha; Government Botanist
for Victoria, and Director of the Botanic Gardens at Melbourne.

Called upon somewhat suddenly to choose the theme for the discourse of this evening, I made my choice unguardedly. I anticipated in my thoughts how, during the intended instructive recreation of this hour, the bearings of intimate botanic knowledge on many an industrial pursuit might readily be demonstrated by some impressive facts. But, on reflection, I saw myself at once surrounded by so varied and bewildering a multitude of objects that to do justice in a few words to my theme became a hopeless task. But while I offer this mere introductory address for a series of lectures on the phytologic section

of this institution, we might learn by a rapid glance over an area of knowledge singularly wide that only through many successive discourses, explaining subjects in detail, the student can become aware of the importance of phytologic knowledge in its relation to the industrial purposes of life. In all zones, except the most icy, mankind depends on plants for its principal wants. For our sustenance, clothing, dwellings, or utensils; for our means of transit, whether by sea or land; indeed, for all our ordinary daily requirements, we have to draw the material largely, and often solely, from the vegetable world. The resources for all these necessities must be—it cannot be otherwise—manifold in the extreme, and singularly varied, again, in different climatic zones, or under otherwise modified conditions.

To render, therefore, these vegetable treasures accessible to our fullest benefit, not only locally, but universally, must ever be an object of the deepest significance. Increasing requirements of the human races and augmented insight into the gifts of nature render now-a-days quite imperative the closest appliances of science to our resources and our daily wants.

“*Omnis tellus optima ferat!*” has become the motto of our Acclimatization Society; or let me quote from Virgil: “*Non omnis fert omnia tellus, hic segetes, illic veniunt felicius vvae.*” Striving to unite the products of many lands, it suffices for us nowhere any longer to discriminate among these resources with merely crude notions; but it becomes necessary to fix accurately, also, as far as plants are concerned, their industrial value, trace their origin, test their adaptability, investigate their productiveness, durability, qualities;

and to reduce all these inquiries to a sound basis by assigning to any species that position in the phytologic system by which it can be recognized by any one in any part of the globe. When the wants of phytology are satisfied we have to call to aid chemistry, therapy, geology, culture, microscopic investigation, pictorial art, and other branches of knowledge, to illustrate the respective value of the species, and the degree of its importance to any particular community. But in the discussions of one evening we can do no more than to touch succinctly only on a few of those vegetable objects most promising to our own colony for introduction, or most accessible among those indigenous here; we may glance on them, also, with a view of learning how their elucidation might practically be pursued, and the knowledge thus gained be diffused. To aid in the latter aim the phytologic section in the Industrial Museum is to be established; of the requirements of this section I shall say a few passing words.

The products and educts of the vegetable world are immense; any display of them in the order of science, as intended for this museum, must carry with it a permanency of impressive instruction which any other modes of teaching, sure to be more ephemeral, fail to convey. But these efforts at diffusing knowledge should be seconded by means not inadequate to a great object, and should be worthy of the dignity and name of this rising country. Who would not like to see the best woods of every country stored up here in instructive samples—nearly a thousand kinds alone to choose from, as far as our continent is concerned? Who would not wish to have here at hand

for comparison the barks, exudations, grains, drugs, as raw material? Who would not desire to have ready access to a series of oils, whether pressed or distilled, whether from indigenous or imported plants? Who would not have it in his power to compare the starches, dyes, casts of our luscious fruits, or the paper-material, tars, acids, coals of various kinds, fibers, alkaloids, and other medicinal preparations from various plants?

Why not place here a series of all the weapons and implements, traced accurately to their specific origin? From such even in many instances we have learned, through keen observations of the first nomadic occupants of the soil, the use of many kinds of wood. All these objects, crude or prepared in the multitudinous way of their adaptations, ought to be accompanied, wherever necessary, by full explanatory designations, microscopic sections, and other means of elucidation; while the periodic issue of descriptive indices, detailing still more copiously the derivation, uses, preparation, and monetary value of such objects, will enable us to serve the full intentions for which this museum section has been formed.

Lectures, however valuable, demonstrations, however instructive, cannot alone form the path of extensive industrial education; most minds, indeed, prefer to dwell tacitly on the objects of their choice, and muse quietly about the adaptability of any of them for operations or improvements in which they may be specially interested.

How many inventions have received their first impulse from an institution such as we wish to form! Investigators, eminent in their profession, will doubt-

less unite here, sooner or later, to bring to bear the sum of their knowledge, earned by a life-long toil, for giving vitality to that information which is to enter guidingly into the ordinary purposes of life. Thus, the happiness and prosperity of our fellow-men should be enhanced and exalted, and one of the loftiest objects of our striving after truths be fulfilled.

But the unassuming worker, conscious how far his own honest intentions advanced beyond his best results, may well exclaim with Moore, in his soft melodies :

“ Ah ! dreams too full of saddening truth,
Those mansions o'er the main
Are like the hopes I built in youth,
As sunny, and as vain ! ”

Let us first take a glance at one of our innumerable forest glens. We see in the deep, rich detritus of rocks and fallen leaves, accumulated in past centuries some of the grandest features of the world's vegetation. Fern-trees* rise, at least exceptionally, to a height of eighty feet, higher, therefore, than any other parts of the globe, unless in Norfolk Island. Mammoth-Eucalypts abound, having, in elevation, rivals only in the Californian Sequoia Wellingtonia ; we may, indeed, obtain, from one individual tree, planks enough to freight almost a ship of the tonnage of the *Great Britain*. Todea Ferns, now sought in trade, occur in these recesses, weighing, deprived of their fronds, almost a ton ; and, if the Xanthorrhœas do resemble, as popularly thought, our once spear-armed natives, then the Todea stems bear certainly as justly a resemblance to large black bears, as has been comically contended. The Fan Palms, † though


* *Alsophila Australis*, R. Br.

† *Corypha (Livistona) Australis*, R. Br.

only occurring in East Gipps Land, within our territory, rank among the most lofty of the globe, though also among the most hardy. All this, in our latitude, seem astounding — but more, it demonstrates, also, great riches ; and I allude to it here only because I wished to show how a vegetation so prodigious points to the facilities of a natural, magnificent, industrial culture. The complex of vegetation is always an indicator of the soil and climate ; as such alone, plants deserve close study. In this instance it reveals untold treasures, and yet, without phytographic knowledge they could never be understood, nor any intelligent appreciation of them be conveyed beyond the locality.

But can this grand picture of nature not be further embellished? Might not the true Tulip-tree, and the large Magnolias of the Mississippi and Himalaya, tower far over the Fern-trees of these valleys, and widely overshadow our arborescent Labiatae ?* Might not the Andine Wax Palm, the Wettinias, the Gingerbread Palm, the Jubea, the Nicau, the northern Sabals, the Date, the Chinese Fan Palms, and *Rhapis flabelliformis*, be associated with our Palm in a glorious picture? Or, turning to still more utilitarian objects, would not the Cork-tree, the Red Cedar, the Camphor-tree, the Walnuts and Hickories of North America, grow in these rich, humid dales, with very much greater celerity than even with all our tending in less genial spots? Could not, of four hundred coniferous trees, and three hundred sorts of Oaks, nearly every one be naturalized in these ranges, and thus

* *Rhododendron arboreum* attains a height of thirty feet, while *Rh. Falconeri* rises to fifty feet, with leaves half a yard long,



deals, select tanning material, cork, pitch, turpentine, and many other products be gained far more readily there than elsewhere in Victoria, from sources rendered our own? Ought we not to test in these valleys how far the Sisso, the Sal, the Teak, may prove hardy, and as important here as our Blackwood and Eucalypts abroad? Or shall I enumerate all the ornamental woods for furniture, machinery, instruments, which form an endless array of genera, and species might be chosen as introducable, indeed, from most lands; many of these, perhaps, to find an asylum in our mountains before—like in St. Helena and other isolated spots—the remarkable and endemic trees are swept by man's destructive agency from the face of the globe? Shall I speak in detail of the trees which yield dyes, and many medicinal substances? If the Turkey Box-tree should continue the best for the wood-engraver, it would, in these valleys, assume its largest dimensions. I do not hesitate in affirming that out of ten thousand kinds of trees, which probably constitute the forests of the globe, at least three thousand would live and thrive in these mountains of ours; many of them destined to live through centuries, perhaps, not a few through twice a thousand years, as great historic monuments. Within the railway-fences, hitherto in this respect unused, trees might be raised as materials for restoring, locally, the sleepers, posts, and rails, prior to their decay. The principles of physiology, the revelations of the microscope, and the results of chemical tests guide us, not only in our selections of the trees, but often teach us, beforehand, the causes and reasons of durability or decay.

The longevity of certain kinds of trees is marvellous. British Oaks are estimated to attain an age of two thousand years. The Walnut-tree, the Sweet Chestnut, and Black Mulberry-tree, live through many centuries, if cared for. Wellingtonias are found to be one thousand one hundred years old. Even the South European Elm, which, since the time of the Romans, has also made Britain its home, is known to stand six hundred years. Dr. Hooker regards the oldest Cedars yet existing, at Mount Lebanon, as two thousand five hundred years old. Historic records are extant of Orange-trees having attained an age of seven hundred years, yet aged trees continue in full bearing, under favorable circumstances; a single tree is said to have yielded, in a harvest, twenty thousand oranges. Individual Olive-trees are also supposed to have existed ever since the Christian era. The European Cypress, the British Yew, the Ginkgo, and the Kauri afford other remarkable instances of longevity.

The Date-Palm gratefully bears its rich crop of fruit for two hundred years. The Dragon-tree of Orotava is another familiar example of extraordinary longevity. Here, in Victoria, the native Beech, and several Eucalypts are veritable patriarchs of the forests, and of a far more venerable age than is generally supposed.

So much for the lasting of some of our work, to encourage planting operations.

If Cook, who stepped with the pride of an explorer on these shores precisely a century ago, could view once more the scene of his discoveries, he would be charmed by the sight of noble cities, and the happy aspect of rural industry; but he would turn his eyes in dismay from the desolation and aridity which a

merciless sacrifice of the native forests has already so sadly brought about—a sacrifice arising from an utter absence of all thoughts for the future. Ever since antiquity this work of forest destruction has gone on in every country, until, sooner or later, such reckless improvidence has been overtaken by a resentful Nemesis, in hindering the progress of national prosperity, and the comfort of whole communities.

After lengthened periods of toil there partially arose, but partially only, what an early guardianship might have readily retained for most countries. When I largely shared in the labors of establishing, for Australian trees, a reputation abroad, I certainly did, also, entertain a hope to awaken here, likewise, a universal interest in the dissemination of an almost endless number of trees from the colder and subtropic girdles of the whole globe. (Vide *Phil. Inst.*, 1858, pp. 93 to 109.) A few scattered trees are of no national moment. We want the massive upgrowth of the Pitch-pines, just as on the Pine barrens of the United States; we want whole forests of the Deal Pines, both cis and transatlantic; we want over all our mountains the Silver Fir, already the charm of the ancients; we want the Australian Red Cedar, scarcely any longer existing in its native haunts; we want the Yarrah-tree, forest-like, as in West Australia; we want the various elastic Ash-trees, which are so easily raised; we want, indeed, no end of other trees, because the greater part of Victoria is ill-wooded; because our climate is hot and dry; because extensive coal layers we have not yet found. What practical bearing can all the teaching in this hall, all the display in this museum, really exercise, if, finally, the artisan finds him-

self without an adequate and inexpensive material for his work? Annually, the timber of one hundred and fifty thousand acres is cut away in the United States to supply the want for railway-sleepers alone. The annual expenditure there in wood, for railway buildings and cars, is £7,600,000. In a single year the locomotives of the United States consume £11,200,000 of wood. The whole wood industries of the United States represent, now, an annual expenditure of one hundred million sterling. There, forty thousand artisans are engaged alone in woodwork. Here, in Victoria, notwithstanding the activity of many saw-mills, we imported, only last year, timber to the value of £270,572 for our own use. As these remarks may find publicity, I have appended further notes on timber-trees, eminently desirable for massive introduction, but do not wish to exhaust by details the patience of this audience.

But it would be vain to expect that Europe and America will continue forever to furnish for us their timber. The constantly-increasing population and the augmented requirements of advancing industries will render no longer yonder woods accessible also to us before the century passes, because even in those northern countries the timber supply will then barely satisfy local wants.

An idea may be formed of forest value when we enter on some calculations of the supply of timber or other products available from one of our largest Eucalyptus-trees. Suppose one of the colossal *Eucalyptus amygdalina* at the Black Spur was felled, and its total height ascertained to be four hundred and eighty feet, its circumference toward the base of the stem

eighty-one feet, its lower diameter to be twenty-six feet, and at the height of three hundred feet its diameter six feet. Suppose *only half* the available wood was cut into planks of twelve inches width, we would get, in the terms of the timber trade, four hundred and twenty-six thousand seven hundred and twenty superficial feet at one inch thickness, sufficient to cover nine and three fourths acres. The same bulk of wood cut into railway-sleepers, six feet by six inches by eight inches, would yield in number seventeen thousand seven hundred and eighty. Not less than a length of twenty-three miles of three-rail fencing, including the necessary posts, could be constructed. It would require a ship of about one thousand tonnage to convey the timber and additional firewood of half the tree; and six hundred and sixty-six drayloads at one and one half tons would thus be formed to remove half the wood. The essential oil obtainable from the foliage of the whole tree may be estimated at thirty-one pounds; the charcoal, suppose there was no loss of wood, seventeen thousand nine hundred and fifty bushels; the crude vinegar, two hundred and twenty-seven thousand two hundred and sixty-nine gallons; the wood-tar, thirty-one thousand one hundred and fifty gallons; the potash, two tons eleven hundred weight. But how many centuries elapsed before undisturbed nature could build up by the subtle processes of vitality these huge and wondrous structures!

Some feelings of veneration and reverence should also be evinced toward the native vegetation, where it displays its rarest and grandest forms. It is lamentable that in all Australia scarcely a single spot

has been secured* for preserving some relics of its most ancient trees to convey to posterity an idea of the original features of our primeval forests. Though it may appear foreign to my subject, I cannot withhold also on this occasion an imploring word, more particularly when I notice land-proprietors in East Australia to hold not even sacred a single native Banyan-tree, which required centuries for building its expansive dome and its hundreds of columnar pillars ; nor to allow a single *Cyrtosia* Orchid to continue with its stem trailing to the length of thirty feet, and to remain with its thousands of large, fragrant blossoms, the pride of the forest. That very *Cyrtosia* gives a clue to the affinity and structure of other plants not nearer to us than Java ; and its destruction, with probably that of many others which the naturalist forever is now prevented to dissect, or the artist to delineate, or the museum custodian to preserve, will be a loss to systematic natural history, also, forever. Again, in a spirit of Vandalism, a Fan-Palm, after a hundred years' growth, is no longer allowed to raise its slender stem and lofty crown in our own forests of Gipps Land, simply because curiosity is prompted to obtain a dishful of Palm-Cabbage at the sacrifice of a century's growth.

Let it be remembered that the uncivilized inhabitants of many a tropical country know how to respect the original and not always restorable gifts of a bountiful Providence. They will invariably climb the Palm-

* On the River Hastings some magnificent dales have been lately protected by the Government of New South Wales for the sake of the incomparably beautiful and grand native vegetation, an example deserving extensive imitation. The forests of the Bunya *Araucaria*, occupying only a limited natural area, are also secured against intrusion by the Government.

tree to obtain its nuts or to plait its leaves ; so, also a resident in our forests might obtain from a grove of our hardy Palms, if still any are left in this land of Canaan, an annual income by harvesting the seeds as one of the most costly articles of horticultural export.

Speaking of Palms, let me observe that the tall Wax Palm of New Granada (*Ceroxylon andicola*) extends almost to the snow-line. It is needless to add that we might grow this magnificent product of andine vegetation in many localities of the country of our own adoption. Each stem yields annually about twenty-five pounds of a waxy, resinous coating, which when melted together with tallow forms an exquisite composition for candles. *Chamærops Fortunei*, a Chinese Fan Palm of considerable height, is here hardy, like in South Europe ; so would be, probably, the Gingerbread Palm (*Hyphaene Thebaica*). Of the value of some Palms we may form an appreciation when we reflect that *Elais Guineensis*, which at the end of this century should be productive in Queensland and North-west Australia, yields from the fleshy outer portion of its nut the commercially famed Palm-oil, prepared much in the manner of Olive-oil ; the value of this African Palm-oil imported in 1861 into England was two millions sterling, the demand for it for soap manufacture, and railway engines and carriages, being enormous.* The Chilean *Jubaea* or Coquito Palm grows spontaneously as far south as the latitude of Swan Hill, and is rich in a melliginous sap.† A Date Palm planted now would still be in full bearing two hundred years hence.

*The import of Palm-oil into Britain during 1868 was nearly a million cwt. (960,059 cwt.).

† Each tree yields ninety gallons of sap at a time, used for the preparation of palm-honey.

When hopeful illusion steps beyond the stern realities of the day, it cannot suppress a desire that enlightened statesmanship will always wisely foresee the absolute requirements of future generations. The colonist who lives in enjoyment of his property near the ranges and sees a flourishing family growing up around him, asks ominously what will be the aspect of these forests at the end of the century, if the present work of demolition continues to go on? He feels that though the forests not solely bring us the rain, through forests only a comparatively arid country can have the full advantage of its showers, as bitter experience has taught generation after generation since Julius Cæsar's time. The colonist reflects with apprehension that while no year nor day, when passed into eternity, can be regained, no provision whatever is made for the coming population, in whose welfare, perhaps as the head of a family, and perhaps even bearing political responsibility, he is interested. He would gladly co-operate in the labors of a local Forest Board, just like members of Road Boards and Shire Councils enter cheerfully on the special duties allotted to their administration. His local experience would dictate the rules under which in each district the timber and other products of the forest could be most lucratively utilized without desolation for the future; and he would be best able to judge, and to seek advice how the yield of the forest could be advantageously maintained, and its riches methodically be increased. All this will weigh more heavily on his mind when he is cognizant that even in Middle Europe, in countries so well provided with coals, and of a much cooler climate than ours, the extent of the forests is kept scru-

pulously intact, and their regular yield remains secured from year to year and from century to century. He would rest satisfied if only the trifling revenue of the forests could be applied by him and his neighbors to an inexpensive restoration of the woods consumed. He would delight in seeing the leading foreign timber trees disseminated with our own Red Gum-tree, Red Cedars, Yarrahs or Blackwoods, not by hundreds but in time to come by millions, well aware that the next generations may either censure reproachfully the shortcomings of their ancestors, or may point gratefully to the results of an earnest and well-sustained foresight of future wants. As a first step, at least in each district a few square miles should be secured for subsequent forest nurseries in the best localities, commanding irrigation by gravitation, and ready access also, before it is too late, and all such spots are permanently alienated from the Crown.

Physical science must yet largely be called to our experimental aid before we can dispel the many crude notions in reference to the effect of forest vegetation on climate in all its details. It is thus a startling fact, as far as experiments under my guidance hitherto could elucidate the subject, that on a sunny day the leaves of our common Eucalypts and Casuarinas exhale a quantity of water several times, or even many times, larger than those of the ordinary or South European Elm, English Oak, or Black Poplar; while from the foliage of our native Silver Wattle only half, or even less than half, the quantity of water is evaporated than from the Poplar or Oak. This degree of exhalation, so different in various trees, depends on the number, position, and size of

their stomata, and stands in immediate correlation to the power of absorption of moisture. Besides, if the evaporation of Eucalyptus-trees is so enormous during heat, and if the often horizontal roots of these trees thus render soil around them very dry, in consequence of the copious conveyance of moisture to the air, they simultaneously, by the rapidity of their evaporation in converting aqueous to gaseous liquid, or water into vapor, cause a lowering of the temperature most important in our climate during the months of extreme heat, while their capability of absorbing moisture during rain or from humid air must be commensurately great.

It is beyond the scope of this address to dwell further on facts like these ; but I was anxious to demonstrate by a mere example how much we have yet to learn by patient research before we will have recognized in all its details the important part which forest vegetation plays in the great economy of nature. Concerning forest culture, I would very briefly allude to an instance showing how, by the teachings of natural science and thoughtful circumspection, the rewards of industrial pursuits may become surprisingly augmented. In the uplands of the Madras Presidency, an ingenious method has been adopted in gathering the harvest of Cinchona-bark, in recent very extensive plantations, by removing it in strips without destroying the cambium layer. Then, by applying moss to the denuded part of the stem, not only is the removed portion of the bark renewed within a year, to the thickness of three years' growth, but the protection of the tender bark against the influence of light and air allows nearly all the quinine and other alkaloids

to remain retained in the cortical layer without decomposition, while in the ordinary three years' bark half or more of these principles is lost.

Facts like these lead us to appreciate the important bearings of the natural sciences on all branches of industry ; but they warn us, also, to pause before we give our further consent to the unlimited and reckless demolition of our most accessible forest lands, on the maintenance of which so many of our industries depend.

Just as it required, even under undisturbed favorable influences, centuries before our forest riches were developed to their pristine grandeur, so it will need, in the ordinary laws of nature, at least an equal lengthened period before we can see towering up again the sylvan colosses, which eminently contributed to the fame of the natural history of this land—if, indeed, the altered physical condition of the country will render the restoration of the trees on a grand scale possible at all.

Has science drawn in vain its isothermal girdles around the globe, or has the searching eye of the philosopher in vain penetrated geologic structure, or in vain the exploring phytographer circumscribed the forms ? Well do we know what and where to choose ; botanic science steps in to define the objects of our choice, which other branches of learning teach us to locate and rear.

The Tea would as thriftily luxuriate in our wooded valleys as in its native haunts at Assam, and yield a harvest far more prolific than away from the ranges. Indeed, we may well foresee that many forest slopes will be dotted in endless rows with the bushes of the

Tea, precisely as our drier ridges are verdant with the vine. Erythroxyton-Coco, the wondrous stimulating plant of Peru, should be raised in the mildest and most sheltered forest glens, where the stillness of the air excludes the possibility of cutting frosts. Hop, cultivated as a leading industry in Tasmania since a quarter of a century, will also take a prominent place on the brooks of our mountains. Peru-bark trees of various kinds should in spots so favored be subjected to culture trials. How easily could any swampy depression, not otherwise readily of value, be rendered productive by allowing plants of the handsome New Zealand flax lily quietly to spread as a source for future wealth. How far the demand of material for industrial purposes may quickly exceed the supply may be strikingly exemplified by the fact that hundreds of vessels are exclusively employed for bringing the Esparto grass (not superior to several of our most frequent sedges) from Spain to England, to augment the supply of rags for the endless increasing requirements of the paper-mills. Conversion of manifold material, even saw-dust, into paper, is carried on to a vast extent; a multitude of samples placed here before you will help to explain how wide the scope for paper material may extend. But the factories want material, not only cheap, but readily convertible, and adapted to particular working.

In all these selections, a few glances through the microscope, and the result of a few chemical reactions taught in this hall, may at once advise the artisan in his choice.

Phytologic inquiry is further to teach us rationally the nature of maladies to which plants are subject,

just as it discloses even the sources of many of the most terrific and ravaging diseases of which the human frame is the victim. The microscope, that marvelous tool for discovery, has become, also, the guardian of many an industry. The processes of morbid growth, or the development and diffusion of the minute organism, between which descriptive botany knows how to discriminate, are thus traced out as the subtle and insidious causes which at times involve losses that count by hundreds of thousands in a single year, even in our yet small communities. But while the microscope discloses the form and development of the various minute organisms which cause, through the countless numbers of individuals, at times the temporary ruin of many branches of rural industry, it leaves us not helpless in our insight how to vanquish the invaders. In correctly estimating the limits of the specific forms, calling forth or concomitant with some of the saddest human maladies, phytography shares in the noble aim of alleviating human sufferings, or restoring health and prolonging vital existence.

But it comes most prominently within the scope of this Industrial Museum to delineate for the agricultural and forest section, in explanatory plates, the morbid processes under which crops and timber may succumb, and an industry be paralyzed or a country be verily brought to famine ; it devolves on us, also, simultaneously to explain the effect of remedial agents, such as sound reasoning from inductive science suggests or confirms. To array samples of all field products which our genial clime allows us to raise is doubtless the object of an instructive institution,

more particularly in a young country, to which immigration streams mainly from a colder zone; but this display of increased capabilities, and of more varied products of a mostly winterless land, may entice the inexperienced to new operations without guarding him against failures. I should even like to see tables of calculations in this Museum, from which could be learned the yield and value of any crop within a defined acreage and from a soil chemically examined; but from this I would regard inseparable a close calculation of the costs under which each particular crop can only be raised. Unfortunately, surprising data are often furnished concerning the productiveness of new plants of culture; but it is as frequently forgotten that the large yield is, as a rule, dependent on an expenditure commensurately large.

Among the most powerful means for fostering phytologic knowledge for local instructive purposes, that of forming collections of the plants themselves remains one of the foremost. No school of any great pretension should be without a local collection of museum plants, nor should any mechanics' institute be without such. It serves as a means of reference most faithfully; it need not be a source of expenditure; it might be gathered as an object of recreation; it may add even to the world's knowledge. Through the transmission of numbered duplicate sets of plants to my office the accurate naming may be secured.* From such a normal collection in each district the inhabit-

* Parcels of plants pressed and dried, and afterward closely packed, can be inexpensively forwarded by post, and, by the excellence of the Australian postal arrangements, can be sent from distant stations of the interior, from whence botanical specimens of any kind, for ascertaining the nature and range of the species, are most acceptable; while full information on such material will at once be rendered.

ant may learn to discriminate at once with exactness between the different timber-trees, the grasses, the plants worthy of ornamental culture, or any others possessing industrial or cultural interest. The sawyer, as well as the trader in timber, may learn how many of the one hundred and forty Australian Eucalypts occur within his reach—how phytography designates each of them by a specific appellation acknowledged all over the globe. Phytologic inquiry, aided by collateral sciences, will disclose to him beforehand the rules for obtaining the wood at the best seasons, for selecting it for special purposes, for securing the best preservation. Phyto-chemistry will explain to him what average percentage of potash, oils, tar, vinegar, alcohol, tannic acid, etc., may be obtained under ordinary circumstances from each. He will understand, for instance, that the so-called Red Gum-tree of Victoria, the one so famed for the durability of its wood and for the peculiar medicinal astringency of its gum-resin, is widely different from the tree of that vernacular named in Western Australia; that it is wanting in Tasmania, yet that it has an extensive geographic range over the interior of our continent; and that thus the experiences gained on the products of this particular species of tree by himself or others are widely applicable elsewhere. Through collections of these kinds the thoughtful colonist may have his attention directed to vegetable objects of great value in his own locality, of the existence of which he might otherwise not readily become aware. New trades may spring up, new exports may be initiated, new local factories be established. Phytographic works on Australian plants, now extant in many vol-

umes, can readily be attached and rendered explanatory of such collections. A prize held out by the patrons of any school might stimulate the juvenile gatherer of plants to increased exertions; his youthful mind will be trained to observation and reflection and the faculties of a loftier understanding will be raised.

To the adult also, and particularly often to the invalid, new sources of enjoyment may thus be disclosed. What formerly was passed by unregarded will have a meaning; every blade over which he stepped thoughtlessly before will have a new interest; and even what he might have admired will gain additional charm; but while penetrating wonders he never dreamt of before he ought piously to ask who called them forth?

“Bright flowers shall bloom wherever we roam,
A voice Divine shall talk in each stream;
The stars shall look like worlds of love,
And this earth shall be one beautiful dream.”

Thos. Moore's Irish Melodies.

What one single plant may do for the human race is perhaps best exemplified by the Cotton-plant. The Southern States of North America sent to England in 1860 nearly half a million tons of cotton (453,522 tons), by which means, in Britain alone, employment was given to about a million of people engaged in industries of this fabric, producing cotton goods to the value of £121,364,458. From rice, which like cotton will mature its crop in some of the warmer parts of Victoria,* sustenance is obtained for a greater number of human beings than from any other plant. In

* Particularly if the hardy mountain rice of China and Japan is chosen, which required no irrigation. The ordinary rice has been grown as far north as Lombardy,

the greater part of the Australian continent, wherever water supply could be commanded, the rice would luxuriate. I found it wild in Arnheim's Land in 1855. Of sugar-cane the hardier varieties may within Victoria succeed in East Gipps Land and other warmer spots. Great Britain imported in 1863 not less than five hundred and eighty-six thousand six hundred tons.* Even our young colony imported last year to the value of nearly a million sterling (£948,329). Think of the commerce in other vegetable products, such as require in different places our local fostering care in order to add still more to our resources. Of various tobaccos we imported into Victoria in 1869 (deducting exports) to the value of £83,788; of wine, £84,687; of cereals, £781,250; of paper, £123,158. I will not enter on any remarks about sugar-beet, on which one of our fellow-colonists has lately compiled an excellent treatise. Of tea, in 1865, Britain required for home consumption eighty-five millions of lbs.† What a prospect for tea growth in Victoria, where this bush cares neither for the scorching heat of the Summer nor for the night-frosts of our lower regions; whereas, in the forest glens of our country, Tasmania, and elsewhere, the Tea-bush would yield most prolific harvests. Test plantations for manifold new cultures were recommended by me years ago in one of my official reports to the Legisla-

*“The total import of sugar into Britain was, during 1868, six hundred and twenty-six thousand three hundred and one tons; during 1869, six hundred and five thousand one hundred and twenty-nine tons.”

† The total import of tea into Britain was—

During 1865.....	121,156,712 lbs.
“ 1866.....	139,610,044 “
“ 1867.....	128,028,726 “
“ 1868.....	154,845,863 “
“ 1869.....	139,223,298 “

ture ; one plantation for the desert, one for subalpine regions, one for the deep valleys of the woodlands. The two latter might be in close vicinity at the Black Spur, and thus within the reach of ready traffic. The outlay in each case would be modest indeed. What an endless number of new industrial plants might thus be brought together within a few hours' drive of the city, under all the advantages of rich soil, shelter, and irrigation ! What an attractive collection for the intelligent and studious might thus be permanently formed.

I will not weary this audience by giving a long array of names of any plants resisting alpine Winters, such as in our snow-clad higher mountains they would have to endure. We know that the Apple will live where even the hardy Pear will succumb ; both will still thrive on our alpine plateaus. The Larch, struggling in vain with the dry heat of our open lowlands, would be a tree of comparatively rapid growth near alpine heights. The Birch, in Greenland, the only tree in Italy ascending to six thousand feet, in Russia the most universal, and there yielding for famed tanning processes its valued bark, is living—to quote the forcible remarks of an elegant writer—“ is living on the bleak mountain sides from which the sturdy Oak shrinks with dismay.” Add to it, if you like, the Paper-Birch, and a host of arctic, andine, and other alpine trees and bushes. Disseminate the Strawberries of the countries of our childhood, naturalize the Blackberry of northern forest moors. The American Cranberry-bush (*Vaccinium macrocarpum*), with its large fruits, is said to have yielded on boggy meadows, such as occupy a large terrain of the Australian

Alps, fully one hundred bushels on one acre in a year, worth so many dollars. If once established, such a plant would gradually spread on its own account for the benefit of future highland inhabitants. The Sugar Maple would seek these cold heights, to be tapped when the Winter snow melts. For half a century it will yield its saccharine sap, equal to several pounds of sugar annually.

Let us translocate ourselves now for a moment to our desert tracts, changed as they will likely be many years hence, when the waters of the Murray River, in their unceasing flow from snowy sources, will be thrown over the back plains, and no longer run entirely into the ocean, unutilized for husbandry. The lagoons may then be lined, and the fertile depressions be studded with the Date Palm ; Fig-trees, like in Egypt planted by the hundreds of thousands to increase and retain the rain, will then also have ameliorated here the clime ; or the White Mulberry-tree will be extensively extant then instead of the Mallee scrub ; not to speak of the Vine, in endless variety, nor to allude to a copious culture of Cotton in those regions. To Fig-trees and Mulberry-trees I refer more particularly, because it must be always in the first instance the object to raise in masses those utilitarian plants which can be multiplied with the utmost ease, and without any special skill, locally, and which, moreover, as in this case, would resist the dry heat of our desert clime. When recommending such a culture for industrial pursuits, it is not the aim to plant by the thousand, but by the million. Remember, also, that a variety of the *Morus Alba* occurs in Afghanistan, with a delicious fruit ; and that the im-

portation of Figs into Britain alone, from countries in climate alike to large tracts of Victoria, has been of late years about one thousand tons annually. What the Fig-tree has effected for rainless tracts of Egypt is now on historic record.

I have spoken of horticultural industries as not altogether foreign to this institution—indeed, as representing a rising branch of commerce. Were I to enter on details of this subject the pages of this address might swell to a volume. But this I would mention, that in our young country the manifold facilities for rearing exotic plants in specially selected and adapted localities could only as yet receive imperfect consideration. We have, however, ample opportunities of selecting genial spots for the growth of such singular curiosities as the Flytrap plant (*Dionæa Muscipula*), and the Pitcher-plants (*Sarracénias*) of the bogs and swamps of the pine barrens and savannahs of Carolina, if we proceed to moory portions of our springy forest land. There is no telling, too, whether the Pitcher-plants of Khasya and China (species of *Nepenthes*) could not readily be grown and multiplied in similar localities, and the hardier of grand Epiphytes among the orchids, such as the subalpine *Oncidium Warczewickyi*, of Central America, which might readily be reared in our glens by horticultural enterprise, together with all the hardier Palms which modern taste has so well adopted for the ready decoration of dwelling-rooms.

Such plants as the *Beaucarnea recurvata* of Mexico, with its five thousand flowers in a single panicle, and the hardier *Vellozias*, from the bare mountain regions of Brazil, would endure our open air; while the in-

numerable South African Heaths, *Stapelieæ*, the *Mesembryanthema*, *Pelargonium*, lily-like plants, and many others, once the pride of European conservatories, can, with increased sea traffic, now gradually be introduced as beautiful objects of trade into this country, where they need no glass protection. It leads too far to speak of the still more readily accessible numerous showy plants of South-west Australia, but among which, as a mere instance, the gorgeous *Anigozanthi*, the lovely *Stylidia*, the gay *Banksiæ*, and the fragrant *Boronias* may be mentioned.

Before leaving this topic, I may remind you that many esculent plants of foreign countries are deserving yet of test culture, and, perhaps, general adoption in this country. The *Dolichos sesquipedalis*, of South American, is a bean, cultivated in France on account of its tender pod. The *Arracha esculenta*, an umbellate from the cooler mountains of Central America, yields there, for universal use, its edible root. The climbing *Chocho*, of West India (*Sechium edule*), proved hardy in Madeira, and furnishes a root and fruit both palatable and wholesome. *Vigna subterranea* is the Earth Nut of Natal. The Taro of Tahiti (*Calocasi macrorrhiza*), though perfectly enduring our lowland clime, is, as yet, with allied species, but little cultivated — neither the Soja of Japan (*Glycine Soja*), nor the Caper of the Mediterranean. The Sea-kales (*Crambe Maritima* and *C. Tatarica*) might be naturalized on our sandy shores.

Regarding fibres, much yet requires to be effected by capitalists and cultivators, to turn such plants as the Grasscloth shrub, which I distributed for upward of a dozen years, to commercial importance for facto-

ries. A kind of Jute (*Corchorus olitorius*) succeeds as far north as the Mediterranean, and grows wild with the Sun Hemp (*Crotalaria juncea*) in tropical Australia; the latter plant comes naturally almost to the boundaries of our colony. A Melbourne rope-factory offers £36 for the ton of New Zealand Flax, and can consume six tons per week. Hemp, used since antiquity, produces, along with its fibre, the Hypnotic Churras. England imported, in 1858, Hemp, to the value of more than £1,000,000.* This may suffice to indicate new resources in this direction. For Sumach our country offers, in many places, the precise conditions for its successful growth, as confirmed by actual tests. Tannic substances, of which the indigenous supply is abundant and manifold, would assume still greater commercial importance by simple processes of reducing them to a concentrated form. How on any forest river might not the Filbert-tree be naturalized; on precipitous places, among rocks, it would form a useful jungle, furnishing, besides, its nuts, the material for fishing-rods, hoops, charcoal crayons, and other purposes. From a single forest at Barcelona sixty thousand bushels are obtained in a year. (For these and many other data brought before you in this lecture you may refer further, most conveniently, to a posthumous work of the great Professor Lindley, *Treasury of Botany*, edited by Mr. Th. Moore, with the aid of able contributors.) Even the Loquat would attain in our forest glens the size of a fair, or even large tree.

* The import of Hemp and Jute into Britain during 1868 was three million two hundred and eighty-one thousand two hundred and sixty-eight hundred weight; during 1869, three million five hundred and fifty-one thousand eight hundred and thirty-eight hundred weight. The undressed Hemp imported in 1868 was valued at £2,022,419.

Osiers and other willows used for basket-work, for charcoal, or for the preparation of salicine, might line any river banks, quite as much for the sake of shade and consolidation of the soil as for their direct utilitarian properties. In the forest ranges any dense line of Willows and Poplars will help to check the spread of the dreadful conflagrations in which so much of the best timber is lost, and through which the temperature of the country is for days heightened to an intolerable degree far beyond the scenes of devastation, while injuries are inflicted far and wide to the labors in the garden or the field. In the most arid deserts the medicinal Aloes might readily be established, to yield by a simple process the drug of commerce. Gourds of half a hundred weight have been obtained in Victoria, and show what the plants of the Melon tribe might do here, like in South Africa, for eligible spots in the desert land. Among the trees for those arid tracts, the glorious *Grevillea robusta*, with its innumerable trusses of fiery red, and its splendid wood for staves, is only one of the very many desirable; just as in the oases the Carob-tree will live without water, uninjured, because its deeply-penetrating roots render it fit to resist any drought. But it may be said that much that I instance is well known and well recorded—so, doubtless, it is, in the abstract—but variety requires to be distinguished from variety, species from species, and their geography, internal structure and components need carefully to be set forth, before any industry relating to plants can be raised on sound ground in proper localities, and be brought to its best fruitfulness.

Even a pond, a streamlet—how, with intelligent

foresight, may it be utilized and rendered lucrative to industry! The Water Nuts,* naturally distributed through large tracts of Europe and Asia, afford at Cashmere alone, for five months in the year, a nutritious and palatable article of food for thirty thousand people. Can the *Menyanthes* not be made a native here—one of the loveliest of water-plants, one of the best of tonics? The true Bamboo, which I first proved hardy here, used for no end of purposes by the ingenious Chinese—can we not plant it here at each dwelling, at each stream, a grateful yielder to industrial wants, not requiring itself any care—an object destined to embellish whole landscapes? An *Arundinaria* Bamboo from Nepal (*A. falcata*) proved very tall and quite hardy, even in Britain; and yet taller is the Mississippi *Arundinaria* (*A. macrosperma*)—indeed, rivaling in height the gigantic Chinese or Indian Bamboo.

Imagine how there might arise on the bold rocky declivities of the Grampians the colossal columns of the *Cereus giganteus* of the extra-tropic Colorado regions—huge candelabras of vegetable structure, which would pierce the roof of our museum hall if planted on the floor, and would be as expansive in width as the pedestal of the monument consecrated to our unfortunate explorers. Picture to yourselves an *Echinocactus Visnago* of New Mexico, lodged in the wide chasm of our Pyrenees, one of these monsters weighing a ton, and expanding into a length of nine feet, with a diameter of three feet. Think of such plants mingled with the Canarian Dragon-tree, one of which is supposed to have lived from our

* Several species of *Trapa*.

Redeemer's time to this age, because four centuries effected on these Giant Lilies but little change. Welwitchia here, like in rainless Damaraland, might grow in our desert sands as one of the most wonderful of plants, its only pair of leaves being cotyledonous and lasting well-nigh through a century. Or associate in your ideas with these one of the medicinal Tree Aloes of Namaqua, or one of the Poison Euphorbias, never requiring pluvial showers (*Euphorbia grandidens*), some as high as a good-sized two-storied dwelling-house; transfer to them also *Cereus senilis*, thirty feet high, which, with all its attempts to look venerable, only succeeds to be grotesque; add to these extraordinary forms such Lily-trees as the *Fourcroya longæva*, with a stem of forty feet and an inflorescence of thirty feet, whereas *Agave Americana*, *Agave Mexicana* and allied species, while they quietly pass through the comparatively short space of time allotted to their existence, weave in the beautiful internal economy of their huge leaves the threads which are to yield the tenacious Pita-cords, so much in quest for the rope-bridges of Central America.

* Some of the Echinocacti extend as far south as Buenos Ayres and Mendoza, and would introduce into many arid tracts of Victoria, together with the almost numberless succulents of South Africa, a great ornamental attraction, which horticultural enterprise might turn to lucrative account; just like our native showy plants will become objects of far higher commercial importance than hitherto has been attached to them. The columns of *Cereus Peruvianus* rise sometimes to half a hundred feet; some Cactæ are in reality the vegetable fountains of the desert. Such

plants as *Echinocactus platyceras*, with its fifty thousand thorns and setæ, should be cultivated in our open grounds for horticultural trade, whereas the *Cochineal Cacti* (*Opuntia Tuna*, *O. coccinellifera* and a few other species), might well be still further distributed here, in order that food may be available for the cochineal insects when other circumstances in Australia will become favorable for the local production of this costly dye.

These are a few of many instances which might be adduced to demonstrate how the landscape pictures of Victoria might be embellished in another century, and new means of gain be obtained from additional manifold resources.

But while your thoughts are carried to other zones and distant lands, let us not lose sight of the reason for which we assembled, namely, to deal with utilitarian objects and the application of science thereon. All organic structures, however, whether giants or pigmies, whether showy or inconspicuous, have their allotted functions to fulfill in nature, are destined to contribute to our wants, are endowed with their special properties, are heralding the greatness of the Creator. But here in this hall I would like to see displayed by pictorial art the most majestic forms in nature, were it only to delineate for the studious the physiognomy of foreign lands, irrespective of any known industrial value of the objects thus sketched. The painter's art in choosing from nature does impress us most lastingly with the value and grandeur of its treasures. Each plant, as it were, has a history of discovery of its own; who would not like to trace it? And this again brings us face to face with those who

carried before us the torch of scientific inquiry into the dark recesses of mystery, and shed a flood of light on perhaps long-concealed magnificence and beauty. The youth, aroused to the sublime feeling of wishing at least to follow great men in independent researches, may be animated if in a hall like this each division were ornamented with the portraits of the foremost of those discoverers who through ages advanced knowledge to the standard of the present day.

“ Deeds of great men all remind us
 We can make our lives sublime,
 And departing leave behind us
 Footprints on the sands of time.

“ Though oft depressed and lonely,
 Our fears are laid aside,
 If we remember only
 Such also lived and died.

“ Learn from the grand old masters,
 Or from the bard sublime,
 Whose distant footsteps echo
 Through the corridor of time.”



LONGFELLOW.

Discovery proceeds step by step. Commenced by original thinkers, enlarged by sedulous experimenters, fostered by the thoughtful portion of the community, and by any administration of high views, it is utilized by well-directed enterprise, and marches onward steadily in its progress. Guttenberg and his collaborators gave us the printing art, which has done more to enlighten the world than all other mechanisms taken together; and though four centuries have altered much in the speed and cost of producing prints, they have not materially changed the forms of this glorious art, as the beautifully-decorated pages of the earliest printed Bibles testify. Thus we have reason to be yet daily grateful for this invaluable gain from the genius of days long passed,

Thoughtless criticism is but too often impatient or success, and demands results premature and unreasonable. Incompetent and perversive censure may even carry the sway of public opinion—misleading, and misled; and, still worse, organized tactics may apply themselves, for sinister purposes of their own, to disturb the quiet work of the discoverer, mar the results of his labors, or paralyze the vitality of research, not understanding, or not wishing to understand, its direction or its object.

And yet, should we have no faith in science, whether it reveals to us the minutest organisms in a perfection unalterable, * or the grandest doctrines of truth, sure ever to bear on human happiness and the peace of our soul; should we have no faith in science, whether it unravels the metallic treasures of the depth and the coals of the forests of bygone ages, or by eternal laws permits us to trace the orbits of endless celestial worlds through space; no faith, if it allows us through spectroscopic marvels to count unerringly the billions of oscillations of each ray of dispersed light within a second; or if it discloses the chemism of distant worlds, and therewith an applicability of research, both tellural and sidereal, ever endless and inexhaustible. Science, as the exponent of God-like

* As an instance of the marvelous complexity, and yet exquisite perfection of the minutest creatures, the organ of vision in insects may be adduced. Most careful observers have ascertained that the eyes of very many insects are compound, contain numerous eyelets; each of these provided with a distinct cornea, lens, iris, pupil, and a whole nervous apparatus. In our despised ordinary house-fly may be counted about four thousand of these most subtle instruments of vision; in some dragon-flies about twelve thousand. Reliable microscopists have counted even seventeen thousand three hundred and fifty-five in a kind of butterfly, while in the beetle genus *mor-della* these most delicate eyelets have been found to rise to the almost incredible number of twenty - five thousand and eighty - eight.—(From *Th. Rym. Jones.*)

laws, draws us in deepest veneration to the power divine. That is true science !

“As into tints of sevenfold ray
Breaks soft the silvery shimmering white;
As fade the sevenfold tints away,
And all the rainbow melts in light;
So from the Iris sportive call
Each magic tint the eye to chain,
And now let truth unite them all,
And light its single stream regain.”

—*Bulwer Lytton, from Schiller.*

If a series of experiments with coloring principles from coal-tar and bituminous substances led to the invention of the brilliant aniline colors, and brought about an almost total change in many dye processes, how many new wonders may not be disclosed to technology by the rapid strides of organic chemistry? As is well-known, three or four chemic elements are only engaged in forming numberless organic compounds, by a slight increase or decrease or rearrangement of the atomic molecules, constructing, for instance, from these three or four elements, ever present and ever attainable, the deadly hydrocyanic acid, the terrible atropin, or the dreadful aconitin at one time; or at another time, harmless ammonia combinations universally used for culinary and other purposes of daily life. Our wood-tars, we may remember, are left, as yet, almost unexamined as regards their chemic constituents. Few of our timbers have been chemically analyzed; few other of our vegetable products are as yet accurately tested. What an endless expanse for exploration does organic chemistry thus offer us! We are called on, among a thousand things, to trace out similar mutual relation and counteraction of such extremely powerful plants as the

Belladonna and Calabar Bean. Here medicine, chemistry, and phytology go hand in hand. How, again, is any analysis of the chemic constituents of any plant, for cultural purposes or otherwise, to be applied, unless we command a language of phytographic expressions which will name with never-failing precision the object before us, and give to its elucidation value and stability ?

We may speak chemically of potash plants, lime plants, and so forth ; we may wish to define thereby the direction of certain industrial pursuits, and we may safely thereby foretell what plants can be raised profitably on any particular soil or with the use of any particular manure ; but how is this knowledge to be fixed without exact phytologic information, or how is the knowledge to be applied, if we are to trust to vernacular names, perplexing even within the area of a small colony, and useless, as a rule, beyond it ? Colonial Box-trees by dozens, yet all distinct, and utterly unlike Turkey Box ; colonial Myrtle, without the remotest resemblance to the poet's myrtle ; colonial Oaks, analogous to those Indian trees which as *Casuarinæ* were distinguished so graphically by Rumpf two hundred years ago, but without a trace of similarity to any real Oak—afford instances of our confused and ludicrous vernacular appellations. A total change is demanded, resting on the rational observations and deductions which science already has gained for us. Assuredly, with any claims to ordinary intelligence, we ought to banish such designations, not only from museum collections, but also from the dictionary of the artisan.

One of the genera of Mushrooms, certainly the

largest of them (*Agaricus*), contains alone about a thousand species, well distinguished from each other, a good many even occurring in this country. For the practical purposes of common life it becomes an object to distinguish the many wholesome from the multitude of deleterious kinds, or the circumstances under which the harmless sorts may become hurtful. In France the cultivation of mushrooms in under-ground caverns has become a branch of industry not altogether unimportant. How, in other instances, is many a culinary vegetable to be distinguished from the poison herb without the microscope of the phytographer being applied to dissections, or without the language of science recording the characters? How many a life, lost through a child's playfulness, or through the unacquaintance of the adult, even with the most ordinary objects of knowledge among plants, might have been saved, even in these times of higher education, if phytologic knowledge was more universal! The species of fungi which can be converted into pleasant, nutritious food are far more numerous than popularly supposed, but for extending industries in this direction botanic science must assume the guardianship. In a technologic hall like this I should like to see instructive portraits also of all the edible and noxious plants likely to come within the colonist's reach.

Among about one thousand kinds of Fig-trees which (so Mons. Alphonse de Candolle tells me), through Mons. Bureau's present writings for the *Prodromus*, are ascertained to exist, only one yields the fig of our table, only one forms the famed sycamore fig, planted along so many roads of the Orient; only one constitutes our own *Ficus macrophylla*, destined, in its

unsurpassed magnificence, to overshadow here our pathways. How are these thousands of species of *Ficus*, all distinct in appearance, in character, and in uses—how are they to be recognized, unless a diagnosis of each becomes carefully elaborated and recorded, headed by a specific name ?

Without descriptive botany all safe discrimination becomes futile. To bear our share in building up an universal system of specific delimitation of all plants is a task well worthy of the patronage of an intelligent and high-minded people. The physician is thereby guided to draw safe comparisons in reference to the action of herbs and roots which he wishes to prescribe, as available from native resources. Thus it was through Victorian researches that not only the close affinity of Goodeniaceæ to the order of Gentianeæ was brought to light, but simultaneously a host of herbs and shrubs of the former order gained for therapeutic uses. When once it was ascertained that the so-called Myrtle-tree of our forest moors was a true Beech the artisan then also found offered to him a timber of great similarity to that of the Beech forests of his British home.

Of the grass genus *Panicum* we know the world possesses, according to a recent botanic disquisition, about eight hundred and fifty species, all more or less nutritive. But one only of these is the famous Copin of Angola (*Panicum spectabile*), one of the Warree (*Panicum miliaceum*), one the Bhadlee (*Panicum pilosum*), one the Derran (*P. frumentaceum*). We might dispense, perhaps, as far as these few are concerned, with their scientific appellations, though not even the mere task of naming has become therewith

easier, and no information whatsoever of their characteristics has been gained. But if we wish to refer to any of the many hundred other species of *Panicum*, in what way are we to express ourselves if even their vernacular names could be collected from at least a dozen of languages, and impressed on any one's memory? They are, as may readily be imagined, very different indeed in their special nutritiveness, degree of endurance, and length of life. Of one hundred and forty species of *Bromus* only one is the Prairie Grass, which has attained already a great celebrity as a pasture grass naturalized in this country; and it is only one other *Bromus*, among the many nutritious kinds, which carries the palm as the most fattening fodder-grass for cold, marshy pastures, and gradually, through depasturing, suppresses completely all other grasses and weeds; so it is proved on the marshlands of Oldenburg. This *Bromus* (*B. secalinus*), as far as I am cognizant, is nowhere as yet economically cultivated in Victoria.

Nothing would be easier than to commence disseminating a number of the best grasses in addition to those already here; for instance, the Canadian Rice-Grass (*Hydropyrum esculentum*) for our swamp-lands. Their nutritive value must be tested by analysis and other experiments, just like that of the Saltbushes of the Murray Flats. Hence ample scope for the exertions of science also in this direction.

In Cotta's celebrated publishing establishment at Stuttgart a most useful work is issued by my friend, Prof. Noerdlinger, on the structure of timber of various kinds, illustrated by microscopic sections of the wood itself; for the latter fascicles I furnished some

material from this colony. The work should be accessible in this Museum to all interested in wood-work.

How much we have yet to learn of the value of our forest products is instanced when we now know from Spanish physicians to combat ague with Eucalyptus-leaves, or when Count Maillard de Marafy, from experiments instituted this year in Egypt, announced to us that Eucalyptus-leaves can be used as a substitute for Sumach. (Egypte Agricole, 1870.)

Already, in the earlier part of this lecture, I spoke of the Peru Bark plants ; but the Cinchonas are not all of the same kind. Some endure a lower degree of temperature than others, some are richer in quinine, others richer in cinchonine, others in quinoidine ; and this again is much subject to fluctuations under different effects of climate and soil. Great errors may be committed, and have been committed, by adopting from among a number of species the least valuable, or one under ordinary circumstances almost devoid of alkaloid, though a representative of the genus cinchona, and not unlike the lucrative species. When calculations in India prognosticate the almost incredible annual return of one hundred and thirty per cent., after four years, on the original outlay for Cinchona plantation, it is supposed that the conditions for this new industrial culture are to the utmost favorable. That one of the best species did not thrive there at all in proportion to expectations is owing, in my opinion, to geologic conditions. The Cinchonas before you, reared in soil from our Fern-tree gullies, I intended to have tested for the percentage of their alkaloids prior to this evening ; but the timely per-

formance of this investigation was frustrated. I think that I have proved the hardiness or adaptability of these important plants for the warm Palm valleys of East Gipps Land, as many indigenous plants from that genial spot are quite as much, if not more, susceptible to the night-frosts of our city than the Cinchonæ, if harsh, cutting winds are kept from the latter. But as yet I am unacquainted with the likely results of remunerative Cinchona cultivation within the boundaries of this colony, as far as such depends on the constituents of the soil. That inquiries of this kind are not mere chimeras may be conceded after an explanation of this kind for the benefit of future technology. Geology, one of the brightest satellites which rotate around the sun of universal science, continues to send its lustre into the darkness which yet involves so many of the great operations in tellurian nature. Further insight into the relation of this discipline of science to vegetable physiology is certain to shed abundance of light also on many branches of applied industry. The causes why the Iron-bark trees of our auriferous quartz ridges differ so materially from the conspecific tree of alluvial flats can only be explained geologically. So it is with the narrow-leaved *Eucalyptus amygdalina* on open stony declivities as compared with the broad-leaved *Eucalyptus fissilis*, which in such gigantic dimensions towers up from our deep forest valleys. But all this has an important bearing on technological exertions in manifold directions. The timber chosen by the artisan from a wrong locality may impair the soundness of a whole building; or a factory may prove not lucrative simply because it is placed on a wrong spot for the best raw material.

A thousand of other industrial purposes might yet be served by a close knowledge of plants. So the designer might choose patterns far more beautiful from the simple and ever-perfect beauty of nature than he gains from distorted forms copied into much of our tapestry ; thus a room, now-a-days, as a rule, decorated with unmeaning and often, as far as imitation of nature is concerned, impossible figures, might become, geographically or phytographically, quite instructive. If here the founders of territorial estates—some, perhaps, as large as the palatinates of the Middle Ages—should wish to perpetuate the custom of choosing a symbol for family arms, they—as the Highland clans, who adopted special plants of their native mountains for a distinguishing badge—might select, as the ancestral emblem, the flowers of our soil, destined, perhaps, to be traced, not without pride, by many a lineage through a hundred generations.

Precise knowledge of even the oceanic vegetation, in its almost infinite display of forms, offers not merely the most delicate objects for design, but brings before us its respective value for manure, or the importance of various herbage on which fishes will browse ; while such marine weeds may as well be transferred from ocean to ocean, as ova of trout have been brought from the far north to these distant southern latitudes. Who could foresee when first iodine was accidentally discovered in sea - weeds, through soda factories, or bromine subsequently appeared as a mere substance of curiosity, what powerful therapeutic agents thereby were gained for medicine, what unique results they would render for chemical processes, of what incalculable advantages they would prove in physiological

researches or microscopic tests; and how, without them, photographic art could not have depicted, with unerring fidelity, millions of objects, whether of landscapes or of the starry sky, whether of the beings dear to us or the relics of antiquity, whether enlarging the scope of lithography or recording the languages, which the flashing of telegraphic electricity sends to a dwelling or to an empire? Even the vegetable fossils, deep-buried in the earth or in the cleavage of rocks, when viewed by the light of phytology, become so many letters on the pages of nature's revelation, from which we are to learn the age of strata, or may trace the sources of metallic wealth, or by which we may be guided to huge remnants of forests of bygone ages, stored up for the utilization of this epoch, or may comprehend, as far as mortal understanding serves us, successive changes in tellurian creation.

When Ray and, subsequently, Jussieu, framed the first groundwork for the ordinal demarcation of plants; when Tournefort, by defining generic limits, brought further clearness into the chaos of dawning systematic knowledge, and when Linnæ gave so happily to each plant its second or specific name, but little was it indeed foreseen what a vast influence these principles of sound methodic arrangement would exercise, not only on the easy recognition of the varied forms of vegetable life, but also on the philosophic elucidation of their properties and uses, and this for all times to come. Many, even at the present day, and among them at times those on whom the destinies of whole states and populations may depend, can recognize in phytographic and other scientific labors but little else than a mere play-work; yet, without

such labors, every solid basis for applying the knowledge of plants to uses of any kind would be wanting. We would stray, indeed, unguided in a labyrinth between crude masses or inordinate fragments, instead of dwelling in a grand and lasting structure of knowledge, unless science also in this direction had raised its imperishable temples. But how much patient and toilsome research had to be spent thus to bring together in a systematic arrangement all the products of this wide globe; how many dangers of exploring travelers had to be braved to amplify the material for this knowledge, and how many have ~~to~~ pass away, even now-a-days, persecuted and worried like Galileo at his time, no one yet has told, nor will tell. Well may we feel with the great German poet, as expressed in Bulwer Lytton's beautiful wording :

“ I will reward thee in a holier land,
Do give to me thy youth!
All I can grant you lies in this command—
I heard, and trusting in a holier land,
Gave my young joys to truth.”

But is there nothing higher than the search of earthly riches, and is to this all knowledge of the earth's beautiful vegetation also to be rendered subservient? Is there nothing loftier than to break the flowers for our gayeties or to strew them along a mirthful path? There is! They raised the noblest feelings of the poet at all ages; they spoke the purest words of attachment; they ever were the silent harbingers of love. They smilingly inspired hope anew in unmeasured sadness, and on the death-bed or at the grave they appear to link together, as symbols of ever-returning springs, the mortal world with immortality; they ever teach us some of the sublimest revelations of our eternal God.

The laurel crown of the hero was a people's highest reward of chivalrous and glorious deeds.

The myrtle or orange-wreath for bridal curls remains the proudest gift to youthful hope.

The little blooming weed, content in a parched and dreary desert, revived the strength of many a sinking wanderer (Mungo Park); the ever unalterable beauty and harmony of moral structures preaches the truths of eternal laws in the universe—a faith that gave expression to Schiller's memorable words, as repeated by that leading British statesman, Gladstone: "It's not all chance the world obeys." The innocent loveliness of nature's flowers has often aroused anew the shaken spirit of the philosopher, and to these and other gifts of nature the American bard alludes when he speaks of the great zoologist, Agassiz, of whose friendship I may well be proud:

" And whenever the way seemed so long,
Or his heart began him to fail,
She would sing a still more wondrous song,
Or tell a more marvellous tale."

And when it seems that all hopes of the weeping mother are extinguished, or even the teachings of religion may well-nigh forsake her, then the deep meaning of some of our noblest poems, inspired by nature, is understood, and faith in eternity once more embraced.

" And the mother gave in tear and pain
The flowers she most did love ;
She knew she would find them all again
In the fields of light above."

" And with childlike credulous affection
We behold their tender bud expand—
Emblems of our own resurrection—
Emblems of the bright and better land."



AUSTRALIAN VEGETATION.

The great continent of Australia exhibits throughout its varied zones marked diversities in the physiognomy of its vegetation. These differences stand less in relation to geographical latitudes than to geological formations, and especially climatical conditions. Yet it is in few localities only where the peculiar features, impressed by nature as a whole on the Australian landscape, cannot at once be recognized. The occurrence of Eucalypts and simple-leaved Acacias in all regions, and the preponderance of these trees in most, suffice alone to demonstrate that in Australia we are surrounded largely by forms of the vegetable world which, as a complex, nowhere re-occur beyond its territory, unless in creations of ages passed by.

In a cursory glance at the vegetation, as intended on this occasion, it is not the object to analyze its details. In viewing vegetable life here, more particularly as the exponent of clime, or as the guide for settlement, or as the source of products for arts and manufactures, we may content ourselves by casting a view only on the leading features presented by the world of plants in this great country. While the absence of very high and wooded mountains imparts to the vegetation throughout a vast extent of Australia a degree of monotony, we perceive that the occur-

rence of lofty forest ranges along the whole eastern and south-eastern coast changes largely there the aspect of the country, and in this alteration the mountainous island Tasmania greatly participates. Thus the extensive umbrageous forest regions of perpetual humidity commence in the vicinity of Cape Otway; extend occasionally, but not widely interrupted, through the southern and eastern part of Victoria, and thence, especially on the seaside slopes of the ranges, throughout the whole of extra-and intra-tropical East Australia in a band of more or less width, until the cessation of elevated mountains on the northern coast confines the regions of continued moisture to a narrow strip of jungle-land margining the coast. In this vast line of elevated coast-country, extending in length over nearly three thousand miles, and which fairly may pass as the "Australian jungle," the vegetation assimilates more than elsewhere to extra-Australian types, especially to the impressive floral features of continental and insular India. Progressing from the Victorian promontories easterly, and thence northerly, we find that the Eucalypts, which still preponderate in the forest of the southern ranges, gradually forsake us, and thus in eastern Gipps Land commences the vast assemblage of varied trees which so much charms by its variety of forms, and so keenly engages attention by the multiplicity of its interest. Bathed in vapor from innumerable springs or torrents, and sheltered under the dark foliage of trees very varied in form, a magnificent display of the Fern-trees commences, for which further westerly we would seek in vain the climatic conditions. Even isolated sentries, as it were, of the Fern-tree masses

are scattered not further west than to the craters of extinct volcanoes near Mount Gambier, and although colossal *Todea* Ferns, with stems six to ten feet high, and occasionally as thick, emerge from the streamlets which meander through the deep ravines near Mount Lofty, on St. Vincent's Gulf, we miss there the stately Palm-like grace of the *Cyathea*, *Dicksonia*, and *Alsophilæ*, which leave on the lover of nature who ever beheld them the remembrance of their inexpressible beauty. These Fern-trees, often twenty to thirty, occasionally fifty to seventy feet high, and at least as many years old, if not older, admit readily of removal from their still mild and humid haunts to places where, for decorative vegetation, we are able to produce the moisture and the shade necessary for their existence. Of all Fern-trees of the globe that species which predominates through the dark glens of Victoria, Tasmania, and parts of New South Wales, the *Dicksonia Antarctica* (although not occurring in the antarctic regions), is the most hardy and least susceptible to dry heat. This species, therefore, should be chosen for garden ornaments, or for being plunged into any park glens; and if it is considered that trees half a century old may with impunity be deprived of their foliage and sent away to distant countries as ordinary merchandise, it is also surprising that a plant so abundant has not yet become an article of more extended commerce.

A multitude of smaller ferns, many of delicate forms, are harbored under the shade of jungle vegetation, amounting in their aggregate to about one hundred and sixty species, to which number future researches in north-east Australia will undoubtedly

add. The circular *Asplenium nidus*, or great Nest Fern, with fronds often six feet long, extends to the eastern part of Gipps Land, but the equally grand Stag-horn Fern (*Platycterium alcicorne* and *P. grande*) seemingly cease to advance south of Illawarra, while in northern Queensland *Angiopteris evecta* count among the most gorgeous, and two slender *Alsophilæ* among the most graceful forms. The transshipment of all these Ferns offers lucrative inducements to traders with foreign countries. Epiphytal Orchids, so much in horticultural request, are less numerous in these jungle-tracts than might have been anticipated, those discovered not yet exceeding thirty in number. Their isolated outposts advance in one representative species—the *Sarcochilus Gunnii*—to Tasmania and the vicinity of Cape Otway, and in another—*Cymbidium canaliculatum*—toward Central Australia. The comparative scantiness of these epiphytes contrasts as strangely with the Indian Orchid-vegetation as with the exuberance of the lovely terrestrial co-ordinal plants throughout most parts of extra-tropical Australia, from whence one hundred and twenty well-defined species are known. Still more remarkable is the almost total absence of Orchids, both terrestrial and epiphytal, from north and north-west Australia, an absence for which in the central parts of the continent aridity sufficiently accounts, but for which we have no other explanation in the north than that the species have as yet there effected but a limited migration. To the jungles and cedar-brushes—the latter so named because they yield that furniture-wood so famed as the Red Cedar (*Cedrela taona*, a tree identical as a species with the Indian plant, though slight-

ly different in its wood) are absolutely confined the Anonaceæ, Laurineæ, Monimieæ, Meliaceæ, Rubiaceæ, Myrsineæ, Sapoteæ, Ebenaceæ, and Anacardiæ, together with the Baccate Myrtaceæ, and nearly all the trees of Euphorbiacæ, Rutaceæ, Apocyneæ, Celastriaceæ, Sapindaceæ, which, while often outnumbering the interspersed Eucalypts, seem to transfer the observer to Indian regions. None in the multitude of trees of these orders, with exception of our tonic-aromatic Sassafras-tree (*Atherospermum moschatum*) and *Hedycarpa Cunninghamsi*, which supplies to the natives the friction-wood for igniting, transgress in the south the meridians of Gipps Land. Palms cease also there to exist, but their number increases northward along the east coast, while in Victoria these noble plants have their only representative in the tall-cabbage or Fan-palm of the Snowy River — that Palm which, with the equally hardy *Areca sapida* of New Zealand, ought to be established wherever the Date is planted for embellishment. Rotang Palms (*Calami* of several species) render some of the northern thickets almost inaccessible, while there, also, on a few spots of the coast, the Coconut-tree occurs spontaneously. A few peculiar Palms occur in the Cassowary country, near Cape York; and others around the Gulf of Carpentaria, as far west as Arnhemland. The tallest of all, the lofty Alexandra Palm (*Ptychosperma Alexandrae*), extends southward to the tropic of Capricorn, and elevates its majestic crown widely beyond the ordinary trees of the jungle. The products of these entire forests is as varied as the vegetation which constitutes them. As yet, however, their treasures have been but scantily subjected to the test of the physi-

cian, the manufacturer, or the artisan. The bark of *Alstonia constricta*, like that of allied Indian species, is ascertained to be febrifugal, so that of *Chionanthus axillaris*, and *Brucea Sumatrana*. Caoutchouc might be produced from various trees, especially the tall kinds of *Ficus*. The lustre and tint of the polished woods of others is unrivaled. Edible fruits are yielded by *Achras Australis*, *Achras Pohlmaniana*, *Mimusops kauki*, *Zizyphus jujuba*, *Citrus Australis*, *Citrus Planchonii*, *Eugenia Myrtifolia*, *Eugenia tierneyana*, *Parinari nonda*, the Candlenut-tree (*Aleurites triloba*), and the cluster Fig-tree (*Ficus vesca*, which produces its bunches from the stem); also by species of *Owenia* and *Spondias*, and by several brambles and vines. Starchy aliment or edible tubers are furnished by *Tacca pinnatifida*, by several *Cissi* (*C. opaca*, *C. clematidea*, acrid when unprepared), *Marsdeni viridiflora*, *Colocasia antiquorum*, *Alocasia macrorrhiza*, by a colossal *Cycas*, some *Zamiæ*, and several kinds of Yam (*Dioscorea bulbifera*, *Dioscorea punctata*, and other species). *Backhousia citriodora* and *Myrtus fragrantissima* yield a cosmetic oil; so, also, *Eucalyptus citriodora*, a tree not confined to the jungle, and two kinds of *Ocimum*. *Semecarpus anacardium*, the marking Nut-tree, is a native of the most northern brush-country. The medicinal *Mallotus Philippinensis*, and the poisonous *Excæcaria Agallocha* are more frequent. *Baloghia lucida* furnishes a red dye never to be obliterated.

Many of the trees of the coast-forests of East Australia range from the extreme north to the remotest south, among them the Palm-panax; others, like *Araucaria Cunninghamsi*, extend only to the northern

part of New South Wales, while some, including *Araucaria Bidwelli*, or the Bunya-Bunya-tree, so remarkable for its large, edible, nutlike seeds, and the Australian Kauri, *Dammara robusta*, are confined to very circumscribed or solitary areas. The absence of superior spice-plants (as far as hitherto ascertained) amidst a vegetation of prevailing Indian type is not a little remarkable, for *Cinnamomum Laubatii* ranks only as a noble timber-tree, and the native nutmegs are inert. The scantiness of acanthaceous plants is also a noticeable fact. *Podostemoneæ* have not yet been found. Many plants of great interest to the phytographer are seemingly never quitting the north-eastern peninsula; among these the Banksian banana (*Musa Banksii*), the pitcher-plant (*Nepenthes Kennedyana*), the vermilion-flowered *Eugenia Wilsonii*, the curious *Helmholtzia acorifolia*, the Marshal-tree, *Archidendron Vaillantii* (the only plant of the vast order of *Leguminosæ* with numerous styles), the splendid *Diplanthera quadrifolia*, *Ficus magnifolia*, with leaves two feet long, the tall *Cardwellia sublimis*, and the splendid *Cryptocarpa Mackinnoniana*, are especially remarkable. *Rhapidophara*, *Pothos*, *Piper*, together with a host of Lianes, especially gay through the prevalence of *Ipomæas*, tend with so many other plants to impart to the jungle part of Australia all the luxuriance of tropical vegetation. Of the two great Nettle-trees, the *Laportea gigas* occurs in the most northern regions, while *Laportea photinifolia* is more widely diffused. *Helicia* is represented by a number of fine trees far south, some bearing edible nuts. *Doryanthes excelsa*, the tall spear-lily, is confined to the forests of New South Wales. The flowers of *Ob-*

erona palmicola are more minute than those of any other orchideous plant, although more than two thousand species are known from various parts of the globe. The display of trees eligible for avenues from these jungles is large. The tall Fern-palm (*Zamia Denisonii*), one of the most stately members of the varied Australian vegetation, is widely, but nowhere copiously, diffused along the east coast; it yields a kind of sago, like allied plants. The beans of *Castanospermum Australe*, which are rich in starch, and those of *Entada pursætha*, from a pod often four feet long, are, with very many other vegetable substances, on which Mons. Thozet has shed much light, converted by the aborigines into food.

If plants representing the genera *Berberis*, *Impatiens*, *Rosa*, *Begonia*, *Ilex*, *Rhododendron*, *Vaccinium*, or, perhaps, even *Firs*, *Cypresses*, and *Oaks*, do at all occur in Australia, as in the middle regions of the mountains of India, it will be on the highest hills of north-east Australia—namely, on the *Bellenden Ker* ranges, mountains still unapproachable through the hostility of the natives—where they will find the cooler and simultaneously moist tropical climate congenial to their existence. But whatever may be the variety and wealth of the primitive flora of East Australia, it is only by the active intelligence and exertions of man that the greatest riches can be wrought from the soil. Whatever plants he may choose to raise—whatever costly spices, luscious fruits, expensive dyes; whether cacao, manihot, or other alimentary plants; whether sugar, coffee, or any others of more extensive tropical tillage—for all may be found wide tracts fitted for their new home.

The close access to harbors facilitates culture, while the expansive extent of geographical latitude on the east coast admits of choosing such spots as in each instance present the most favorable climatic conditions for the success of each special plantation. Beyond the coast ranges the country westward changes with augmenting dryness generally at once into more open pastoral ground. Basaltic downs and gentle verdant rises of eminent richness of herbage may alternately give way to Brigalow scrubs, or sandstone plateaux, or porphyritic or granitic hills, and with the change of the geological formation a change, often very apparent, will take place also in the vegetation. Inland we will lose sight of the glossy, dense, umbrageous foliage, which now only borders a generally low coast in the north, terminating there frequently in mangroves. *Strychnos nux vomica* occurs among the coast-bushes here, and also an *Antiaris* (*A. macrophylla*); but whether the latter shares the deadly poison of the Upas-tree of Java and Sumatra requires to be ascertained. *Tamarindus Indica* is known from Arnhem-land, and the French bean (*Phaseolus vulgaris*) in a spontaneous state from the north-west coast. Eucalypts, again, form away from the sea the prevailing timber, but with the exception of the Red Gum-tree (*Eucalyptus rostrata*), which lines most of the rivers of the whole of the Australian interior, the southern species are replaced by others, never of gigantic growth, in some instances adorned with brilliant scarlet or crimson blossoms. But neither these nor many distinct kinds of northern *Acacias* and *Melaleucas* stamp on the country the expression of peculiarity. Familiar Australian forms usually surround us, though

those of the cooler zone, and even the otherwise almost universal *Senecios*, are generally absent. *Cyperus vaginatus*, perhaps the best of all textile rushes, ranges from the remotest south to these northern regions. *Hibiscus tiliaceus*, with other malvaceous plants, is here chosen by the natives for the fibre of their fishing-nets and cordage. An occasional interspersion of the dazzling *Erythrina vespertilio*, of *Bauhinia Leichardti*, *Erythrophlæum Laboucheri*, *Livistonia Palms*, and many *Terminaliæ*, some with edible fruits, *Cochlospermum Gregorii*, *C. heteroneum*, remind, however, of the flora of tropical latitudes, which, moreover, to the eye of an experienced observer, is revealed also in a multitude of smaller plants, either identical with South Asiatic species or representing in peculiar forms tropical genera. The identity of about six hundred Asiatic plants (some cosmopolitan) with native Australian species, has been placed beyond doubt, and to this series of absolutely identical forms, as well derived from the jungle as from grounds free of forest, unquestionably several hundred will yet be added.

Melaleuca leucadendron, the Cajeput-tree of India, is among Indo-Australian trees one of the most universal; it extends, as one of the largest timber-trees of north Australia, along many of its rivers, and in diminutive size over the dry sand-stone table-lands. The Asiatic and Pacific *Casuarina equisetifolia* accompanies it often in the vicinity of the coast. By far the most remarkable form in the vegetation of north-west Australia is the Gouty-stem-tree (*Adansonia Gregorii*); but it is restricted to a limited tract of coast-country. It assumes precisely the bulky form

of its only congener, the Monkey-bread-tree, or Baobab of tropical Africa (*Adansonia digitata*), dissimilar mainly in having its nuts not suspended on long fruit-stalks. Evidence, though not conclusive, gained in Australia, when applied to the African Baobab, renders it improbable that the age of any individual tree now in existence dates from remote antiquity. This view is also held by Dr. G. Bennett, of Sydney. The tree is of economic importance; its stem yields a mucilage indurating to a tragacanth-like gum. It is also one of the few trees which introduces the unwonted sight of deciduous foliage into the evergreen Australian vegetation. Numerous swamps and smaller lakes exist within moderate distance of the coast; as in many other parts of Australia, these waters are surrounded by the wiry *Polygonum* (*Muehlenbeckia Cunninghami*), and in Arnhemland occasionally also by rice-plants, not distinct from the ancient culture-plant. But here, in almost equinoctial latitudes, the stagnant fresh waters are almost invariably nourishing two Water-lilies of great beauty (*Nymphæa stellata* and *Nymphæa gigantea*), which give, by the gay display of their blue, pink, or crimson shades of flowers, or by their pure white, a brilliant aspect to these lakes; and even the Pythagorean bean (*Nelumbo nucifera*) sends occasionally its fine shield-like leaves and large blossom and esculent fruits out of the still and sheltered waters. But how much could this splendor of lake-vegetation be augmented if the reginal Victoria, the prodigious Water-lily of the Amazon River, was scattered and naturalized in these lakes, to expand over their surface its stupendous leaves, and to send forth its huge, snowy, and crimson, fragrant flowers,

It would add to the aliment which the natives now obtain from these lakes and swamps by diving for the roots and fruits of the *Nymphæ*, or for the tubers of *Heleocharis sphacelata*, of species of *Aponogeton*, or by uprooting the starchy rhizomes of *Typha angustifolia* (the Bullrush), when eager of adding a vegetable compound to their diet of *Unio* shells, or of water-fowls and fishes, all abounding on these favorite places of their resort. *Trapa bispinosa*, already living, like the *Victoria*, in the tanks of our conservatories, ought, with *Trapa natans*, for the sake of its nuts, not only to be naturalized in the waters of the north, but also in the lagoons and swamps of the south. Around these lakes *Screw-Pines* (*Pandanus spiralis* and *Pandanus aquaticus*) may often be seen to emerge from the banks, the latter, as recorded already by *Leichhardt*, always indicative of permanent water. The young top-parts of the stems of these *Pandans*, when subjected to boiling, become free of acidity, and thus available, in cases of emergency, for food. *Opilia amentacea* and the weeping *Eugenia eucalyptoides*, together with a native cucumber (*Cucumis jucunda*), are here among the few plants yielding edible fruit. *Purslane* (*Portulaca oleracea*) abounds, and in sandy soil it is found pleasantly acidulous. It will always be acceptable, as a salad or spinach, especially in affections from scurvy, and its amylaceous seeds might, in cases of distress, be readily gathered for food. A delicious tall perennial spinach (*Chenopodium auricamum*) is not unfrequent. Beyond one kind of *Sandarach* *Callitris* no *Pines* exist in the north, except the *Araucaria Greyi*, noticed on a circumscribed spot on the *Glenelg* river. The true *Bamboo* (*Bambusa*

arundinacea) lines, as far as yet discovered, only the banks of a few of the rivers of Arnheims-land.

To the pastoral settler, for whom more particularly the generally open Eucalyptus country or the treeless or partly scrubby tracts are eligible, it must be of significance that the rainfall occurs with frequency during the hottest part of the year. Hence, during the Summer, grass and herbage is pushing forth with extraordinary rapidity and exuberance, while a judicious burning at the cooler season, together with the effect of regular dews, is certain to produce fresh forage during the dryer months. An almost endless variety of perennial nutritious grasses, allied to Indian species, or even identical with them, are known to exist. The basaltic downs of the north and north-west produce almost precisely the same vegetation which has rendered Darling and Peak Downs so famed in the east. This almost absolute identity of plants is a sufficient indication of great semblance of climate, for which the rise of the country, though one not very considerable, to some extent may account. On the ranges which divide the waters of the east coast from those of Carpentaria the vine luxuriates; its fruit, indeed, suffers occasionally from frost.

How far the tract south of the more littoral northern country may continue to bear prevaillingly the features of fertility cannot be predicated. There can be no greater fallacy than to prejudge an untraversed country—a fallacy to which explorers are prone, and which, in some instances, has retarded advancement of geographical discoveries and of new locations of permanent abodes, while, in other instances, it has led to disastrous consequences. A country should be

judged with caution. Even from elevations comparatively inconsiderable, as such nearly always proved away from the eastern coast, the orb of vision is limited. A traveler may, buoyant with hope, commence his new daily conquest on the delightful natural lawns or the verdant slopes of a trap formation; and, before many hours' ride, he may, to his dismay, be brought without water to a bivouac between the sand-waves of decomposed barren rocks. But as suddenly a few hours' perseverance may bring him again into geological regions of fertility when he least expected it; smiling landscapes may again burst into his view, and he may establish his next camp on limpid water, sufficient for the requirements of a future city. The nature of a country is not ruled by climate and latitude alone, but quite as much, if not more, by its geological structure. Glancing on the map of an unexplored country, we are apt to take in our conjectures the former alone for a guide, until the latter, by actual field-operations, becomes our stronghold in topographical mapping. It would thus be unsafe to assume that the great western half of the interior consists mainly of desolate, uninhabitable desert-country, or even to contend that the reappearance on Termination Lake, or on the Murchison river, of so very many of the plants which give to the saltbush country, or the Mallee and Brigalow scrubs, on the extensive depression of the Darling system, their physiognomy, necessitates their uninterrupted extension from the rear of Arnhems-land to the Murray Desert, or to Shark Bay. From demonstrating-facts like these we dare no more infer but that likely many similar tracts of flat country are stretching over portions of the wide interven-

ing spaces. But who will predict more? May not the large system of salt lakes formed by the drainage of rain into cavities of saline flats be found limited to the less distant portions of the interior of Western Australia, and may it not thus, by a gradual rise of the ground (evidently manifest northerly), give place to a system of fresh-water lakes or lagoons, or even of such springs as rewarded the exertions of the keenly-searching explorers west of Lake Eyre? And although it must be admitted that no ranges simultaneously lofty and wooded, and thus originating springs and rivulets for the formation of larger rivers, are likely to exist to any extent in the extra-tropical part of the western interior, because such rivers have not found their way to the coast; yet it is still possible, and rather probable, that mountains as high, and much less bare than Gawler Range, and even much more extensive, may give rise to interior water-courses, along which the dwellings of new colonists may be established, and to which our pasture-animals may flock, but which, in their sluggish progress, cannot force their way to the ocean, and are thus lost in numerous more or less ample inland basins. Years hence, on even less-favored spots, artesian borings may afford the means of stay for a dense population, should, as may be anticipated, mineral riches prove to be scattered not merely over the vicinity of the west coast and Spencer's Gulf, but also over interjacent areas of geological similarity. York's Peninsula, close to settlements, was long left an uninhabited and desolate spot until its richness of copper-ore was disclosed. So other unmapped parts of Australia are also likely to prove rich; and, although equal facilities for the

transit of the mineral treasures would not always exist, its discovery would be certain to lead to the occupation of the country and to the extension of pastoral colonization, until an increasing population and augmented conveniences for traffic could turn mineral wealth, however distantly located, advantageously to account. But how vastly might not any barren tracts of the interior be improved, and how many a lordly possession be founded, by patient industry and intelligent judgment! Storage of water, raising of woods, dissemination of perennial fodder-plants, will create alone marvellous changes; and for these operations means are readily enough at command. Even the scattering of the grains of the common British Orache (*Atriplex patulum*), an annual but autumnal plant, would, on the barest ground, realize fodder for sheep; and the number of plants which for such purpose could be chosen are legion. The storage of rain-water might, in any rising valley, be so effected as to render it, simply by gravitation, available for irrigating purposes.

As a curious fact, it may be instanced that, in some of the waterless sandy regions of South Africa, the copious naturalization of melon-plants has afforded the means of establishing halting-places in a desert country. On the sandy shores of the Great Bight, and also anywhere in the dry interior, such plants might be easily established. The avidity with which the natives at Escape Cliffs preserved the melon-seeds, after they once had recognized the value of their new treasure, holds out the prospect of the gradual diffusion of such vegetable boons over much unsettled country,

No part of Australia has the marked peculiarities of its vegetation so strongly expressed, and no part of this great country produces so rich an assemblage of species within a limited area as the remotest south-western portion of the continent. Indeed, the southern extremity of Africa is the only part of the globe in which an equally varied display of vegetable forms is found within equally narrow precincts, and endowed also with an equal richness of endemic genera. It is beyond the scope of this brief treatise to enter fully into a detailed exposition of the constituents of the south-western flora. It may mainly suffice to view such of the vegetable products as are drawn already into industrial use, or are likely to be of avail for the purpose. Foremost in this respect stands, perhaps, the Mahogany-Eucalypt (*Eucalyptus marginata*). The timber of this tree exhibits the wonderful quality of being absolutely impervious to the inroads of the limnoria, the teredo, and chelura—those minute marine creatures so destructive to wharves, jetties, and any work of naval architecture exposed to the water of the sea; it equally resists the attacks of termites. In these properties the Red Gum-tree of our own country largely shares. The Mahogany-Eucalypt has, in the Botanic Gardens of this city, been brought for the first time largely under cultivation, and as, clearly, the natural supply of this important timber will, sooner or later, prove inadequate to the demanded requirements, it must be regarded as a wise measure of the governments of France and Italy now to establish this tree on the Mediterranean shores—a measure for which still greater facilities are here locally offered.

The Tuart (*Eucalyptus gomphocephala*) is another of the famed artisan's woods of south-western Australia. The Karri (*Eucalyptus colossea* or *diversicolor*) attains, in favorable spots, a height of four hundred feet. *Eucalyptus megacarpa* constitutes the Blue Gum-tree, which rivals that of Tasmania and Victoria in size, but is otherwise very distinct. Its timber, as well as that of the Tuart, on account of their hardness, are employed for tramways and other works of durability. The fragrant wood of several species of *Santalum* forms an article of commercial export. Some kinds of *Casuarina*, quite peculiar to that part of Australia, furnish superior wood for shingles and for a variety of implements. Several species of *Acacia*, especially *Acacia acuminata*, the raspberry-scented Wattle, equally restricted to the south-west coast, yield fragrant and remarkably solid wood and a pure gum. To this part of Australia was naturally also restricted the *Acacia lophantha*, which has, for the sake of its easy and rapid growth and its umbrageous foliage, assumed such importance, even beyond Australia, for temporary shelter-plantations. Many other products, such as gum-resins, sandarach, tanner's bark, all of great excellence, are largely available; but these substances show considerable similarity to those obtained in other Australian colonies.

The extraordinary abundance, however, of the *Xanthorrhoeas* through most parts of the south-west territory gives special interest to the fact (1845) promulgated by Stenhouse, that anthrazotic, or nitro-pieric acid—a costly dye—may, with great ease and little cost, be prepared from the resin of these plants. Indeed, this is the richest source for this acid, the resin

yielding half its weight in dye. Fiber of great excellence and strength is obtained from the bark of *Pimelea clavata*, a bush widely distributed there. It resembles that of bast from *Pimelea axiflora* in Gipps Land, and that from *Pimelea microcephala* of the Murray and Darling desert. A Fern-palm (*Zamia Fraseri*) attains in West Australia a height of fifteen feet. It is there, like some congeners of America and South Africa, occasionally sacrificed for the manufacture of a peculiar starch, though the export of the stems (and perhaps of those of the *Xanthorrhœas* also) would prove much more profitable, inasmuch as these, when deprived of their noble crown of leaves, though not of their roots, will endure a passage of many months, even should the plants be half a century old. Such any wool-vessel might commodiously take to Europe. This alimentary Fern-palm, well appreciated by the aborigines for the sake of its nuts, together with a true kind of Yam (*Dioscorea hastifolia*), the only plant on which the natives, in their pristine state, anywhere in Australia, bestowed a crude cultivation, are, with species of *Borya*, *Sowerbæa*, *Hæmodorum*, *Ricinocarpus*, *Macarthuria*, *Chloanthos*, *Aphanopetalum*, *Xylo-melum*, *Caleana*, *Calectasia*, *Petrophila*, *Leschenaultia*, *Pseudanthus*, *Nematolepis*, *Nuytsia* (the terrestrial mistletoe), *Leucolæna*, *Commersonia*, *Rulingia*, *Keraudrenia*, *Mirbelia*, *Gastrolobium*, *Labichea*, *Melichrus*, *Monotaxis*, *Actinotus*, and *Stypandra*, remarkable for their geographical distribution; because, as far as we are hitherto aware, these West Australian genera have no representatives in the wide interjacent space until we approach toward the eastern, or, in a few instances, to the northern regions of Austr-

lia, *Zamia* alone having been noticed in South Australia (*Zamia Macdonnellii*), but there as an exceedingly local plant. Neither climate nor geologic considerations explain this curious fact of phytogeography. Over some of the healthy tracts of scrub-country, toward the south-west coast, poisonous species of *Gastrolobium* (*Gastrol bilobum*, *G. oxylobioides*, *G. calycinum*, *G. callistachys*) are dispersed. These plants have, in some localities, rendered the occupation of country for pastoral pursuits impossible, but these poison-plants are mostly confined to barren spots, and it is not unlikely that, by repeated burnings, and by the raising of perennial fodder-plants, they could be suppressed, and finally extirpated. Fortunately, in no other parts of Australia *Gastrolobium* occurs, except on the inland tract from Attack Creek to the Sutor River, where flocks must be guarded against access to the scrub-patches harboring the only tropical species (*Gastrolobium grandiflorum*). The deadly effect occasionally produced by *Lotus Australis*, a herb with us of very wide distribution, and extending also to New Caledonia, and the cerebral derangements manifested by pasture animals, which feed on the Darling River pea (*Swainsona Greyana*), need yet extensive investigation, but may find their explanation in the fact that the organic poisonous principle is only locally, under conditions yet obscure, developed; or in the probable circumstance that, like in a few other leguminous plants, the deleterious properties are strongly concentrated in the seed. The gorgeous desert-pea (*Clanthus Dampierii*), which, in its capricious distribution, has been traced sparingly from the Lachlan River to the north-west coast, offers still to seed-collectors a lucrative gain.

A prominent aspect in the vegetation of south-west Australia emanates from the comparatively large number of singularly beautiful *Banksia*-tree, preponderant there as the arborous *Grevilleæ* in North Australia. The existence of but two of that genus, *Banksia Australis*, and *B. ornata*, in the extensive tract of interior and coast land, from the head of the Australian Bight, to the vicinity of Port Philip, renders the occurrence of an increased number of trees of this kind in East Australia again still more odd. Rutaceous and goodeniaceous plants, though in no part of the Australian continent rare, attain in the south-west their greatest numerical development, and should not be passed silently, or, like *Epacrideæ*, as merely ornamental plants, though still so rare in our gardens; but these elegant plants deserve also attention for their diaphoretic properties, or for the bitter tonic principle which pervades nearly all the species of the two orders. *Stylideæ* are here still more numerous than in our north, and comprise forms of great neatness; while sundews (*Droseræ*) are also found to be more frequently than in any other part of Australia, and indeed of the globe. When, glittering in their adamantine dew, they reappear as the harbingers of Spring from year to year, they are greeted always anew with admiration. But the greatest charm of the vegetation consists in the hundreds of myrtaceous bushes peculiar to the west, all full of aromatic oil; among these again, the feather-flowered numerous *Verticordiæ*, the crimson *Calothamni*, and the healthy *Calythrices* vie with each other as ornaments. Still also of this order many gorgeous plants exist in other parts of, especially extra-tropical Australia. The numerous bushes of Legu-

minosæ, and Proteacæ, in south-west Australia, are also charming. The introduction of all these into European conservatories might be made the object of profitable employment. Annual herbs of extreme minuteness, belonging chiefly to Compositæ, Umbelliferæ, Stylideæ, and Centrolepideæ, are here, as in other parts of extra-tropical Australia, in their aggregate more numerous than minute phanerogamic plants in any other part of the globe. A line of demarcation for including the main mass of the south-west Australian vegetation may almost be drawn from the Murchison River, or Shark Bay, to the western extremity of the Great Bight; because to these points penetrates the usual interior vegetation, which thence ranges to Sturt's Creek, to the Burdekin, Darling, and Murray rivers, while the special south-west Australian flora ceases to exist as a whole beyond the limits indicated.

The marine flora of south-west Australia is likewise eminently prolific in specific forms, perhaps more so than that of any other shore. Many of the algæ are endemic, others extend along the whole southern coast and Tasmania, where again a host of species proved peculiar; some are also extra-Australian. The whole eastern coast contrarily, and also the northern and the north-western, with the exception of a few isolated spots, such as Albany Island, contrast with the southern coast as singularly poor in algæ. In a work exclusively devoted to the elucidation of the marine plants of Australia—a work which as an ornament of phytographic literature stands unsurpassed, and which necessitated lengthened laborious researches of its illustrious author, the late Professor Harvey, here on the spot—the specific limits of not less than eight hundred algæ

are fixed. Some of these are not without their particular uses. A few yield caragaheen, all bromine and iodine. *Macrocystis pyrifera*, the great kelp, which may be seen floating in large masses outside Port Philip Heads, attains the almost incredible length of many hundred feet, while a single plant of the leathery, broad *Urvillea potatorum* constitutes a heavy load for a pack-horse.

The wide, depressed interior, once supposed to be an untraversable desert, consists, as far as hitherto ascertained, much less of sandy ridges than of sub-saline or grassy flats, largely interspersed with tracts of scrub, and occasionally broken by comparatively timberless ranges. The great genus *Acacia*, which gives to Australia alone about three hundred species (and, therefore, specific forms twice as numerous as that of any Australian generic type), sends its shrubs and trees also in masses over this part of the country, where, with their harsh and hard foliage, they are well capable to resist the effect of the high temperature during the season of aridity, while they are equally contented with the low degree of warmth to which, during nights of the cool season, the dry atmosphere becomes reduced. Handsome bushes of *Eremophila*, with blossoms of manifold hue, decorate the scrubs throughout the whole explored interior. Among the desert *Cassiæ* two simple-leaved kinds are remarkable. Of the *Acaciæ*, none here, except *A. Farnesiana*, have pinnated leaves, and even one is leafless; the pinnated *Acaciæ* being restricted to the more littoral tracts, and even there from the Great Bight to Guichen Bay entirely absent. If shelter plantations of the rapidly-growing *Eucalypts*, *Acacias*,

and Casuarinas were raised, a vast variety of useful plants could be reared along the water-courses of the more central parts of Australia. Saltbushes, in great variety, stretch far inland, and this is the forage on which flocks so admirably thrive. Probably the extensive Asiatic steppes have to boast of no greater diversity of salsolaceous plants than our own. Nevertheless, even here much could be added to the productiveness of these pasturages by the introduction of other perennial fodder herbs. Grasses, wherever they occur, are varied, and a large share is perennial, nutritious, and widely diffused. As corroborative, it may be instanced that *Anthistiria ciliata*, the common kangaroo-grass, almost universally ranges over Australia, and thus also over the central steppes of the continent. It extends, indeed, to Asia and North Africa also. Besides, through the interior, grasses, especially of *Panicum* and *Andropogon*, are numerous, either on the oases, or interspersed with shrubs on barren spots. *Festuca* or *Triodia irritans*, the porcupine-grass of the settlers, is restricted to the sands of the extra-tropical latitudes; *Festuca* or *Triodia viscida*, chiefly to the sandstone table-lands of the tropics.

Only in the south-eastern parts of the continent, and in Tasmania, are the mountains rising to alpine elevations. Mount Hotham, in Victoria, and Mount Kosciusko, in New South Wales, form the culminating points, each slightly exceeding seven thousand feet in height. In the ravines of these summits lodge perennial glaciers; at six thousand feet snow remains unmelted for nearly the whole of the year, and snow-storms may occur in these elevations dur-

ing the midst of Summer. At five thousand feet the vegetation of shrubs generally commences, and up to this height ascend two Eucalypts, *Eucalyptus coriaceæ* and *Gunnii*, forming dense and extensive thickets; *E. coriaceæ* assuming, however, in lower valleys, huge dimensions. Both these, with most of our alpine plants, would deserve transplanting to middle Europe, and to other countries of the temperate zone, where they would well cope with the vicissitudes of the climate. In Tasmania, the Winter snow-line sinks considerably lower, and in its moister clime many alpine plants descend there along the torrents and rivulets to the base of the mountains which here are constantly clinging to cold elevations. Mount William is the only sub-alpine height isolated in Victoria from the great complex of snowy mountains, but it produces, beyond *Eucalyptus alpina*, and *Pultenæa rosea*, which are confined to the crest of that royal mountain, only *Celmisia longifolia* and little else as the mark of an alpine or rather subalpine flora. *Celmisia* also is one of the few representatives of cold heights in the Blue Mountains; and from New England we know only *Scleranthus biflorus*, a cushion-like plant, exquisitely adapted for margining garden plots, and *Gualtheria hispida*, as generally indicating spots on which snow lodges for some of the Winter months. The mountains of Queensland would need in their tropical latitudes a greater height than they possess for nourishing analogous forms of life, but the truly alpine vegetation of the high mountains of Tasmania contrasts in some important respects with that of the Australian Alps—namely, therein that under the prevalence of a much higher degree of humidity,

plants which delight to be bathed in clouds, or in the dense vapors of the surrounding Fern-tree valleys, are much more universal; and that the number of peculiar alpine genera is much greater than here. Thus, while in Tasmania the magnificent Evergreen Beech (*Fagus Cunninghami*) covers many of the ranges up to sub-alpine rises, it predominates as a forest-tree in Victoria only at the remotest sources of the Yarra, the Latrobe, and the Goulburn rivers, and on Mount Baw-Baw. To this outpost of the Australian Alps (now so accessible to metropolitan tourists) are restricted also several plants, such as *Oxalis Magellanica* and *Libertia Lawrencii*, which are almost universal on all the higher hills of Tasmania. *Fagus Cunninghami*, though descending into our Fern-tree ravines, transgresses nowhere the Victorian land-boundaries, but a noble fagus-forest, constituted by a distinct and equally evergreen species, *Fagus Moorci*, crowns the high ranges on which the Bellinger and M'Leay rivers rise. This, however, the snowy mountains of Tasmania and of continental Australia have in common, that the majority of the alpine plants are not representing genera peculiar to colder countries, but exhibit hardy forms, referable to endemic Australian genera, or such as are allied to them. So, as already remarked, we possess alpine species, even of *Eucalyptus* and of *Acacia*, besides of *hibbertia*, *oxylobium*, *bossiæa*, *pultenæa*, *eriosomon*, *boronia didiscus*, *epacris*, *leucopogon*, *prostanthera*, *grevillea*, *hakea*, *persoonia*, *pimelea*, *kunzea*, *baeckea*, *stackhousia*, *mitrasacme*, *xanthosia*, *coprosma*, *velleya*, *prasophyllum*; yet *anemone*, *caltha*, *antennaria*, *gaultheria*, *alchemilla*, *seseli*, *cœnothera*, *huanaca*, *abrotanella*,

ligusticum, astelia, gunnera, and other northern or western types, are not altogether missing, though nowhere else to be found in Australia but in glacial regions.

About half a hundred of the highland plants are strictly peculiar to Victoria; the rest prove mainly identical with Tasmanian species; but a few of ours, not growing in the smaller sister-land, are, strange as it may appear, absolutely conspecific with European forms. Rather more than one hundred of the lowland plants ascend, however, to the glacial regions; some of these are simultaneously desert-species.

The only genus of plants absolutely peculiar to the Victorian territory, *Wittsteinia*, occurs as a dwarf sub-alpine plant, of more herbaceous than woody growth, restricted to the summits of Mount Baw-Baw; this, moreover, remained hitherto the only representative of *vaccinieæ* in all Australia; it produces, like most of the order, edible berries.

The verdant Summer-herbage of valleys, which snow covers during the Winter months, will render with increasing value of land-estates these free, airy, and still retreats in time fully occupied as pasturage during the warmer part of the year. Here, in sheltered glens, we have the means of raising all the plants delighting in the coolest clime. Rye-culture could probably be carried on at considerable elevation.

Of all the phanerogamic plants of Tasmania, about one hundred and thirty are endemic; of those about eighty are limited to alpine elevations, or descend from thence only into cool, umbrageous valleys. The generic types peculiar to the island are again almost

all alpine (*milligania*, *campynema*, *hewardia*, *pterygopappus*, *tetracarpæa*, *anodopetalum*, *cystanthe*, *prionotis*, *microcachrys*, *diselma*, *athrotaxis*, *pherosphæra*, *bellendena*, *cenarrhenes*, *archeria*), only *acradenia* and *agastachys* belonging seemingly to the lowlands, but show at once a fondness for a wet, insular clime. The few Tasmanian genera, represented besides only in Victoria, are *richea*, *diplarrhena*, *drymophila*, *juncella*. In the Tasmanian highlands flora endemic shrubby asters and epacridæ, and the singular endemic pines of various genera, constitute a marked feature. A closer and more extended inquiry into the geological relation of great assemblages of vegetation will shed probably more light on the enigmatic laws by which the dispersion of plants is ruled. Australian forms predominate also in Tasmania, at snowy heights, so *Eucalyptus gunnii*, *E. coccifera*, and *E. urnigera*. The famous Huon-pine (*Daerydium Franklini*), the Palmheath (*Richea pandanifolia*), the celery-topped pine (*Phyllocladus rhomboidalis*), and the deciduous beech (*Fagus Gunnii*) are among the most striking objects of its insular vegetation. Mosses, lichenæ, lichens, and conspicuous fungi abound both in alpine and low regions; indeed, cryptogamic plants, except Algs and microscopic fungi, are nowhere in Australia really frequent except in Tasmania, in the Australian Alps, and in the Fern-tree glens of Victoria and part of New-South Wales. The Musk-tree (*Aster argophyllus*) of Tasmania and south-east Australia is the largest of the few trees produced by the vast order of *compositæ* in any part of the globe, while *Prostanthera lasianthos*, its companion, exhibits the only real tree known in the extensive family of

Labiatae. The almost exclusive occupation of vast littoral tracts of Gippsland, and some of the adjoining islands, by the dwarf *Xanthorrhœa minor*, is remarkable. Mistletoes do not extend to Tasmania, though over every other part of Australia; neither the Nardoo (*Marsilea quadrifolia*), of melancholic celebrity, though to be found in every part of the continent, and abounding in innumerable varieties throughout the depressed parts of the interior. Equisetaceæ occur nowhere. The total of the species to be admitted as well-defined, and hitherto known, from all parts of Australia, approaches (with exclusion of microscopic fungi) to ten thousand.

It has been deemed of sufficient importance to append to this brief memoir an index of all the trees hitherto discovered in any part of Australia. Such statistics lead to reflection and comparison. They also bring more prominently before the contemplative mind the real access which in any branch of special knowledge may have been obtained. In this instance it is the only table with which this document has been burdened, though kindred lists might have readily been elaborated. Nor would this imperfect sketch of Australian vegetation have been extended to any detailed enumerations whatever did not the trees impress on the vegetation of each country its most distinctive feature, and had we not learned how great a treasure each land possesses in its timber—whether as raw product to artisans or as objects of therapeutic application, whether as material for the products of manifold factories or as the source of educts in the chemical laboratory; whether as the means of affording employment to the workman, or even as the me-

dium for regulating the climate. May we revert only to the circumstance, as elucidating the great physiographic characters of countries and their mutual relation, that notwithstanding the close proximity of New Zealand, *none* of its trees (though very many of its herbs) are positively identical with any observed in Australia; and yet, hundreds of ours can in no way be distinguished from Indian trees. Moreover, in a philosophical contemplation of the nature of any country and the history of its creation, our attention is likely to be in the first instance engaged in a survey of the constituents of its pristine forests, and greatly is it to be feared that in ages hence, when much of the woods will have sunk under ruthless axes, the deductions of advanced knowledge thereon will have to be based solely on evidence early placed on record.

The marvellous height of some of the Australian, and especially Victorian trees, has become the subject of closer investigation since, of late, particularly through the miners' tracks, easier access has been afforded to the back-gullies of our mountain system. Some astounding *data*, supported by *actual* measurements, are now on record. The highest tree previously known was a Karri - Eucalyptus (*Eucalyptus colossea*), measured by Mr. Pemberton Walcott, in one of the delightful glens of the Warren River of western Australia, where it rises to approximately four hundred feet high. Into the hollow trunk of this Karri three riders, with an additional pack-horse, could enter and turn in it without dismounting. On the desire of the writer of these pages, Mr. D. Boyle measured a fallen tree of *Eucalyptus amygdalina*, in the deep recesses of Dandenong, and obtained for it

the length of four hundred and twenty feet, with proportions of width, indicated in a design of a monumental structure placed in the Exhibition ; while Mr. G. Klein took the measurement of a Eucalyptus on the Black Spur, ten miles distant from Healesville, four hundred and eighty feet high! Mr. E. B. Heyne obtained at Dandenong as measurements of height of a tree of *Eucalyptus amygdalina*: Length of stem from the base to the first branch, two hundred and ninety-five feet; diameter of the stem at the first branch, four feet; length of stem from first branch to where its top portion was broken off, seventy feet; diameter of the stem where broken off, three feet; total length of stem up to place of fracture, three hundred and sixty-five feet; girth of stem three feet from the surface, forty-one feet. A still thicker tree measured, three feet from the base, fifty-three feet in circumference. Mr. George W. Robinson ascertained, in the back-ranges of Berwick, the circumference of a tree of *Eucalyptus amygdalina* to be eighty-one feet at a distance of four feet from the ground, and supposes this Eucalypt, toward the sources of the Yarra and Latrobe rivers, to attain a height of half a thousand feet. The same gentleman found *Fagus Cunninghami* to gain a height of two hundred feet and a circumference of twenty-three feet.

It is not at all likely that in these isolated inquiries chance has led to the really highest trees, which the most secluded and the least accessible spots may still conceal. It seems, however, almost beyond dispute, that the trees of Australia rival in length, though evidently not in thickness, even the renowned forest-giants of California, *Sequoia* *Wellingtonia*, the highest

of which, as far as the writer is aware, rise in their favorite haunts at the Sierra Nevada to about four hundred and fifty feet. Still, one of the mammoth trees measured, it is said, at an estimated height of three hundred feet, eighteen feet in diameter! Thus to Victorian trees for elevation the palm must apparently be conceded. A standard of comparison we possess in the spire of the Munster of Strasbourg, the highest of any cathedral of the globe, which sends its lofty pinnacle to the height of four hundred and forty-six feet, or in the great pyramid of Cheops, four hundred and eighty feet high, which, if raised in our ranges, would be overshadowed probably by Eucalyptus-trees.

The enormous height attained by not isolated, but vast masses of our timber-trees in the rich diluvial deposits of sheltered depressions within Victorian ranges, finds its principal explanation, perhaps, in the circumstance that the richness of the soil is combined with humid geniality of the climate, never sinking to the colder temperature of Tasmania, nor rising to a warmth less favorable to the strong development of these trees in New South Wales, nor ever reduced to that comparative dryness of air which even to some extent, in the mountain-ravines of South Australia, is experienced. The absence of living gigantic forms of animal life amidst these the hugest forms of the vegetable world is all the more striking.

Statistics of actual measurement of trees compiled in various parts of the globe would be replete with deep interest, not merely to science, but disclose also, in copious instances, magnitudes of resources but little understood up to the present day. Not merely,

however, in their stupendous altitude, but also in their celerity of growth, we have, in all probability, to accede to Australian trees the prize. Extensive comparisons instituted in the Botanic Garden of this metropolis prove several species of Eucalyptus, more particularly *Eucalyptus globulus*, and *Eucalyptus obliqua*, as well as certain *Acacias*—for instance, *Acacia decurrens*, or *Acacia mollissima*—far excelling in their ratio of development any extra-Australian trees, even on dry and exposed spots, such into which spontaneously our Blue Gum-tree would not penetrate. This marvellous quickness of growth, combined with a perfect fitness to resist drought, has rendered many of our trees famed abroad, especially so in countries where the supply of fuel or of hard woods is not readily attainable, or where for raising shelter, like around the *Cinchona*-plantations of India, the early and copious command of tall vegetation is of imperative importance. To us here this ought to be a subject of manifold significance. I scarcely need refer to the fact that for numerous unemployed the gathering of *Eucalyptus*-seeds, of which a pound weight suffices to raise many thousand trees, might be a source of lucrative and extensive employment; but on this I wish to dwell: that in Australian vegetation we probably possess the means of obliterating the rainless zone of the globe, to spread at last woods over our deserts, and thereby to mitigate the distressing drought, and to annihilate, perhaps, even that occasionally excessive dry heat evolved by the sun's rays from the naked ground throughout extensive regions of the interior, and wafted with the current of air to the east and south—miseries from which the prevalence

of sea-breezes renders the more littoral tracts of West and North Australia almost free. But in the economy of nature the trees, beyond affording shade and shelter, and retaining humidity to the soil, serve other great purposes. Trees, ever active in sending their roots to the depths, draw unceasingly from below the surface-strata those mineral elements of vegetable nutrition on which the life of plants absolutely depends, and which, with every dropping leaf, is left as a storage of aliment for the subsequent vegetation. How much lasting good could not be effected, then, by mere scattering of seeds of our drought-resisting Acacias, and Eucalypts, and Casuarinas, at the termination of the hot season along any water-course, or even along the crevices of rocks, or over bare sands or hard clays, after refreshing showers? Even the rugged escarpments of the desolate ranges of Tunis, Algiers, and Morocco might become wooded; even the Sahara itself, if it could not be conquered and rendered habitable, might have the extent of its oases vastly augmented; fertility might be secured again to the Holy Land, and rain to the Asiatic plateau, or the desert of Atacama, or timber and fuel be furnished to Natal and La Plata. An experiment instituted on a bare ridge near our metropolis demonstrates what may be done.

Not Australia alone, but some other countries, have judiciously taken advantage of the facilities afforded by Australian tree-vegetation for raising woods—an object which throughout the interior might be initiated by rendering this an additional purpose of the expeditions to be maintained in the field for territorial and physiographical exploration; and more, it

might deserve the reflection of the Legislature, which allots to the pastoral tenants their expansive tracts of country, whether or not along with squatting pursuits—indeed, for the actual benefit of the pastoral occupant himself the inexpensive first steps for general forest-culture in the woodless regions should be commenced.

Within the ranges which produce these colossal trees but few habitations exist; indeed, we might traverse a line of a thousand miles as yet without a dwelling. The clime is salubrious; within the sheltered glens it cannot in excellence be surpassed. Hot winds, from which our exposed plains, as well as any rises of northern and western aspect, so much suffer, never reach the still and mild vales of the forests; frosts are only experienced in the higher regions. Speaking of Victoria especially, it is safe to assert that there alone many thousand square miles of mountainous country, timbered with Stringy-bark trees (*Eucalyptus obliqua*) are as yet lying dormant for any other but isolated mining operations. And yet, might not families which desire to strike out a path of independent prosperity, which seek a simple patriarchal life in a salubrious locality of seclusion, and which command the needful strength of labor within their own circle, choose these happy glens as their permanent abodes? Though the timbered rises of the ranges may be as yet unproductive for cultivation, or even be sterile, the valleys are generally rich, irrigated by clear brooks, and spacious enough for isolated homes, and the limited number of pasture animals pertaining to them. The costlier products of culture might be realized, especially so in the Fern-tree glens; tea,

and possibly cinchona, and coffee also ; so, lucrative fibres, dye-plants of easy growth and simple preparation, as instanced by grass-cloth, or madder ; or medicinal plants, such as senna, and various herbs, or, perhaps, even the *Erythroxylon coca*, a plant of almost fabulous properties. Or should the settler prefer, beyond raising the simple requirements for his rural life, to devote his attention solely to the gain which the surrounding timber treasures are certain to offer, he will find ample scope for his energy and industry. The Eucalypts, as now proved by extensive and accurate experiments, will yield him tar in abundance ; they will furnish fibres, even those of Stringy-bark as one of the cheapest and most extensively available paper material. By a few simple appliances he may secure, simultaneously with the tar, also wood-vinegar and wood-spirit ; and these again might locally be at once converted into dye materials and varnishes. He might obtain potash from woods, and volatile oils from the leaves of Eucalypts in almost any quantity, by artless processes and with scarcely any cost. He might gather the gum-resins and barks for either medicinal or tanning purposes, or he might effect a trade in Fern-trees ; he might shake the Eucalyptus grains out of their capsules, and might secure locally other mercantile substances far too numerous to be enumerated here. Whoever may choose these ranges as a permanent home, and may direct thoughtfully his attention to the future, will recognize that the mere scattering of the acorns of the Cork-tree or the seeds of the Red Cedar over cleared and yet sheltered ground, or the planting of the vine and olive, will yield to his descendants sources of great riches.

In closing these concise and somewhat chaotic suggestions, which scarcely admit of methodical arrangement, unless by expansion into the chapters of a volume, we may—indulging in a train of thought—pass from special to general considerations.

Belgium, one of the most densely populated of all countries, and yet one of the most prosperous, nourished within an area less than one half that of Tasmania a population three times exceeding that of all the Australian colonies ; yet one fifth of the Belgian territory consists of forests. Not to any considerable extent smaller than Europe, our continent is likely to support in ages hence a greater population ; because, while here no frigid zone excludes any portion of the territory from productiveness, or reduces it anywhere to very circumscribed limits, it embraces a wide tropical tract, destined to yield us products nowhere to be raised under the European sky. The comparatively unbroken uniformity of vast tracts of Australia certainly restricts us for the magnificent sceneries and the bracing air of the countries of our youth here to the hilly coast-tracts ; but still we have not to endure the protracted colds of middle and northern European Winters, nor to contend with the climatic difficulties which beset tillage operations or pastoral pursuits, and which, by patient perseverance, could not be removed or be materially lessened.

While we are deprived of advantages so pleasing and so important as those of large river communications, we enjoy great facilities for land traffic, facilities to which every new discovery of coal-layers will add.

Judicious forest culture, appropriate to each zone, will vastly ameliorate the climate, and provide for the dense location of our race ; for transplanting of almost every commodity, both of the vegetable and animal empire, we possess, from the Alps to the Steppes, from the cool mountain forests to the tropic jungles, conditions and ample space.

River-waters, now flowing unutilized to the ocean, when cast over the back plains, and artesian borings also, will effect marvellous changes. Steam power and the increased ingenuity of machinery applied to cultivation will render the virgin soil extensively productive with far less toil than in older countries, while the teachings of science will guard us against the rapacious systems of culture and the waste of fertilizers which well-nigh involved ruin to many a land. Of ferocious land animals Australia is free. We have neither to encounter extensive hordes of savages to dispute the possession of the soil, nor the still more dangerous opposition of half-civilized barbarians, such as for ages yet may obstruct the progress of civilization in the great interior of Africa.

Our continent, it may be foretold prophetically, will ere long be regarded of so high a territorial value that *no* tract, however much disregarded now, will remain unoccupied. Our continent, surrounded moreover by the natural boundaries of three oceans, free and unconnected, must advance, by extraneous influences undisturbed, by ancient usages unretarded, to that greatness to which British sovereignty will ever give a firm stability.

THE

TREES OF AUSTRALIA,

PHYTOLOGICALLY NAMED AND ARRANGED, WITH
INDICATIONS OF THEIR TERRITORIAL
DISTRIBUTION.

No plants have been inserted in this list unless their height approached to thirty feet, although in a few instances they attain only exceptionally this standard. But *Cystanthe procera* and *Epacris heteroneuma* in the deep, swampy, forest recesses of South Port, and *Corrœa Lawrenciana* in the dark fern-tree ravines toward Cape Otway, rise to the adopted standard-height; while *Melaleuca squarrosa*, in the deep irriguous forest-glens at Sealer's Cove, has been noted eighty feet high, with a stem forty feet long, and two feet thick. It was preferable to admit these, and a few other generally shrubby plants into this tree-list, were it only to render the luxuriance of the vegetation on these hardly-ever traversed spots universally understood. The list comprises approximately nine hundred and fifty trees. Of these, eighty-eight occur in south-western Australia, sixty-three in the terri-

tory of the colony of South Australia, one hundred and forty-six in that of Victoria, sixty-six in Tasmania, three hundred and eighty-five in New South Wales, not less than five hundred and twenty-six in Queensland, two hundred and twelve in North Australia, and twenty-nine in Central Australia. To the number of the Tasmanian and Victorian trees future observers will add but little. The list of those from western Australia and south Australia is certain to receive additions by further discoveries in the interior, but probably the increase will not be extensive. About twenty-five trees from New South Wales, known to exist, could not be recorded, the corresponding material in our museum admitting of no accurate examination. The cedar brushes, moreover, as well as the interior, are likely to yield still a limited number of hitherto unknown trees to future search. Queensland and North Australia are throughout the littoral and jungle tracts as yet imperfectly explored, and we yet expect to derive from these hundreds of additional trees, many of which doubtless will be of special interest and value both to the phytographer and the artisan. Central Australia, according to the narrower or wider limitation we may arbitrarily assign to it, is likely to furnish a considerable number of new trees, while others will be traced in that direction; but probably no new kinds of any great dimensions will be found. The construction of tabulated lists of trees indigenous to other parts of the globe would serve manifold useful comparisons; as yet none of those of Europe even are extant. It is contemplated to construct for all those trees which are not already provided with vernacular names free of

ambiguity, and such as bear a logical meaning, new English appellations, as far as possible in consonance with the uses or the phytographic name of the tree.

[W.A. indicates West Australia; S.A., South Australia; T., Tasmania; V., Victoria; N.S.W., New South Wales; Q.L., Queensland; N.A., North Australia; C.A., Central Australia.]

DICOTYLEDONEÆ.

I.—CHORIPETALEÆ.

DILLENACEÆ.

Dillenia Andreana, F. M., Q.L.; *Wormia alata*, Br., Q.L.

MAGNOLIACEÆ.

Drimys aromatica, F. M., T. V.; *D. dipetala*, F. M., N. S. W.; *D. membranacea*, F. M., Q. L.

ANONACEÆ.

Fitzgeraldia mitrastigma, F. M., Q. L.; *Polyalthia nitidissima*, Benth, Q. L.; *Melodorum Leichhardtii*, Benth, N. S. W.; Q. L.; *Eupomatia laurina*, Br., V., N. S. W., Q. L.

MONIMIACEÆ.

Atherosperma moschatum, Lab., T., V., N. S. W.; *A. sassafras*, J. Hook, N. S. W.; *A. micranthum*, Tul., N. S. W., Q. L.; *Mollinedia Wardellii*, F. M., Q. L.; *Wilkiea calyptrocalyx*, F. M., N. S. W., Q. L.; *Hedycarya Cunninghamsii*, Tul., V., N. S. W.

MYRISTICÆÆ.

Myristica cimicifera, Br., Q. L.; *M. insipida*, Br., Q. L.

CAPPARIDEÆ.

Cadaba capparoides, Cand., N. A.; *Capparis sarmentosa*, Cunn., N. S. W., Q. L.; *Busbeckia nobilis*, Endl., N. S. W., Q. L.; *B. Mitchellii*, F. M., S. A., V., N. S. W., Q. L., N. A., C. A.; *Apophyllum anomalum*, F. M., N. S. W., Q. L.

VIOLARINEÆ.

Hymenanchera Banksii, F. M., T., V., N. S. W., Q. L.

POLYGALEÆ.

Xanthophyllum Macintyrii, F. M., Q. L.

COCHLOSPERMEÆ.

Cochlospermum heteronemum, F. M., N.A.; *C. Gregorii*, F. M., Q.L., N.A.

BIXACEÆ.

Scolopia Brownii, F. M., N.S.W., Q.L.; *Xylosma ovatum*, Benth., Q.L.

PITTOSPOREÆ.

Pittosporum rhombifolium, Cunn., N.S.W., Q.L.; *P. melanospermum*, F.M., Q.L., N.A.; *P. undulatum*, Vent., V., N.S.W.; *P. ovatifolium*, F.M., Q.L.; *P. phillyroides*, Cund., W.A., S.A., V., N.S.W., Q.L., N.A., C.A.; *P. bicolor*, Hook., T., V., N.S.W.; *Hymenosporum flavum*, F.M., N.S.W., Q.L.; *Bursaria spinosa*, Cav., W.A., S.A., T., V., N.S.W., Q.L., N.A., C.A.

GOMPHIACEÆ.

Brackenridgea Australiana, F. M., Q.L.

GUTTIFERÆ.

Calophyllum inophyllum, L., Q.L., N.A.

ERYTHROXYLEÆ.

Erythroxylon Australe, F. M., Q.L.

SIMARUBEÆ.

Ailantus punctata, F. M., N.S.W., Q.L.; *A. imberbiflora*, F. M., Q.L.; *Brucea Sumatrana*, Roxb., Q.L., N.A.; *Cadellia pentastylis*, F. M., N.S.W.; *C. monostylis*, Benth., N.S.W.

MELIACEÆ.

Sandoricum Indicum, L., Q.L.; *S. nervosum*, Bl., Q.L.; *Melia Azedarach*, L., N.S.W., Q.L., N.A.; *Dysoxylon oppositifolium*, F. M., Q.L.; *D. latifolium*, Benth., Q.L.; *D. Fraseri*, Benth., N.S.W.; *D. Muellieri*, Benth., N.S.W., Q.L.; *D. Nernsti*, F.M., Q.L.; *D. Lesserti*, Benth., N.S.W.; *D. Klanderi*, F. M., Q.L.; *D. rufum*, Benth., N.S.W., Q.L.; *Hearnia sapindina*, F. M., Q.L.; *Aglaia elæagnoides*, Benth., Q.L., N.A.; *Amoora nitidula*, Benth., N.S.W., Q.L.; *Synoon glandulosum*, Juss., N. S.W., Q.L.; *Owenia acidula*, F. M., Q.L.; *O. vernicosa*, F. M., N.A.; *O. venosa*, F. M., Q.L.; *O. reticulata*, F. M., N.A.; *Carapa Moluccensis*, Lam., Q.L., N.A.; *Cedrela Taona*, Roxb., N. S.W., Q.L.; *Flindersia Australis*, Br., Q.L.; *F. Schottiana*, F. M., N.S.W., Q.L.; *F. Oxleyana*, F. M., N.S.W., Q.L.; *F. Bennetiana*, F. M., N.S.W., Q.L.; *F. Brayleana*, F. M., Q.L.; *F. Strzeleckiana*, F. M., N.S.W., Q.L.

RUTACEÆ.

Correa Lawrenceana, Hook., T., V.; *Boronia arborescens*, F. M., T., V., N.S.W., Q.L.; *Acradenia Franklinia*, Kipp., T.; *Bosistoa sapindiformis*, F. M., N.S.W., Q.L.; *Pagetia medicinalis*, F. M., Q.L.; *Euodia neurococca*, F. M., N.S.W., Q.L.; *E. erythrococca*, F. M., N.S.W., Q.L.; *E. octandra*, F. M., N.S.W., Q.L.; *E. Bonwickii*, F. M., Q.L.; *E. haplophylla*, F. M., Q.L.; *E. micrococca*, F. M., N.S.W., Q.L.; *E. xanthoxylodes*, F. M., Q.L.; *E. Elleryana*, F. M., Q.L.; *E. Cunninghami*, F. M., N.S.W., Q.L.; *Coatesia paniculata*, F. M., Q.L.; *Geijera salicifolia*, Schott, W.A., S.A., V., N.S.W., Q.L., N. A., C.A.; *Xanthoxylon brachyacanthum*, F. M., Q.L.; *X. Blackburnia*, Benth., N.S.W.; *X. parviflorum*, Benth., N.A.; *Aconychia Baueri*, Schott, N.S.W., Q.L.; *A. laevis*, Forst., N.S.W., Q.L.; *A. imperforata*, F. M., N.S.W., Q.L.; *A. acidula*, F. M., Q.L.; *A. vistita*, F. M., Q.L.; *A. melicopoides*, F. M., Q.L.; *Glycosmis pentaphylla*, Corr., Q.L.; *Micromelum pubescens*, Blume, N.S.W., Q.L., N.A.; *Murraya exotica*, L., Q.L.; *M. crenulata*, Oliv., Q.L.; *Citrus Planchonii*, F. M., Q.L.; *C. Australasica*, F. M., N.S.W., Q.L.

MALVACEÆ.

Plagianthus sidoides, Hook., T.; *P. pulchellus*, Gray, T., V., N.S.W.; *P. Berthæ*, F. M., W.A.; *Howittia trilocularis*, F. M., V., N.S.W.; *Hibiscus tiliaceus*, L., N.S.W., Q.L., N. A.; *H. Patersoni*, Cand., Q.L.; *H. populneus*, L., Q.L., N.A.; *Adansonia Gregorii*, F. M., N.A.; *Bombax Malabaricum*, Cand., N.A.

STERCULIACEÆ.

Sterculia fetida, L., N.A.; *S. quadrifida*, Br., N.S.W., Q.L., N.A.; *Brachychiton ramiflorum*, Br., N.A.; *B. discolor*, F. M., N.S.W., Q.L.; *B. incanum*, Br., N.A.; *B. luridum*, Moore, N.S.W.; *B. platanoides*, Br., Q.L., N.A.; *B. acerifolium*, F. M., N.S.W., Q.L.; *B. populneum*, Br., V., N.S.W., Q.L.; *B. diversifolium*, Br., N.A.; *B. Gregorii*, F. M., W.A.; *B. Dela-bechei*, F. M., Q.L.; *Tarrietia argyrodendron*, Benth., N.S.W., Q.L.; *L'Heritirea litoralis*, Ait., Q.L.; *Helicteres isora*, L., N. A.; *Abroma festuosa*, L., Q.L.; *Commersonia Fraseri*, Gay, V., N.S.W.; *C. echinata*, Forst., N.S.W., Q.L.; *Seringea platyphyl-la*, Gay, N.S.W.

TILIACEÆ.

Berrya Ammonilla, Roxb., Q.L.; *Grewia multiflora*, Juss., Q.L., N.A.; *G. latifolia*, F. M., Q.L.; *Sloanea Australis*, F. M., N.S.W., Q.L.; *S. Langii*, F. M., Q.L.; *Elæocarpus foveolatus*, F. M., Q.L.; *E. holopetatus*, F. M., V., N.S.W.; *E. obovatus*, Don., N.S.W., Q.L.; *E. cyaneus*, Ait., V., N.S.W., Q.L.; *E. Arnhemicus*, F. M., N.A.; *E. Grandis*, F. M., N.S.W., Q.L.

PHYTOLACCEÆ.

Codonocarpus cotinifolius, F. M., W.A., S.A., V., N.S.W., C.A.; *C. pyramidalis*, F. M., S.A.

AMARANTACEÆ.

Deeringia altissima, F. M., N.S.W., Q.L.

NYCTANGINEÆ.

Pisonia excelsa, Bl., Q.L., N.A.

OLACINEÆ.

Ximena Americana, L., Q.L.; *Pemantia Cunninghamsii*, Miers., N.S.W.; *Villaresia Moorei*, F. M., N.S.W.; *V. Smythii*, F.M., Q.L.; *Byronia Arnhemensis*, F. M., N.A.

ANACARDIACEÆ.

Rhus rhodanthemum, F. M., N.S.W., Q.L.; *Buchanania augustifolia*, Roxb., Q.L., N.A.; *Euroschinus falcatus*, J. Hook., N.S.W., Q.L.; *Semecarpus Anacardium*, L., Q.L., N.A.; *Spondias Solandri*, Benth., Q.L.; *S. pleiogyna*, F. M., Q.L.

BURSERACEÆ.

Garuga floribunda, Decaisne, N.A.; *Canarium Australianum*, F. M., Q.L., N.A.

VINIFERÆ.

Vitis hypoglauca, F. M., V., N.S.W., Q.L.; *Leea sambucina*, Willd., Q.L., N.A.

SAPINDACMÆ.

Diploglottis Cunninghamsii, J. Hook, N.S.W., Q.L.; *Erioglossum edule*, Blume., N.A.; *Schmidelia serrata*, Cand., Q.L.; N.A.; *Cupania punctulata*, F. M., Q.L.; *C. anacardioides*, Rich., N.S.W., Q.L., N.A.; *C. Robertsonii*, F. M., Q.L., N.A.; *C. serrata*, F. M., N.S.W., Q.L.; *C. tomentella*, F. M., N.S.W., Q.L.; *C. Mortoniana*, F. M., Q.L.; *C. Pseudo-Rhus*, Rich., N.S.W., Q.L.; *C. erythrocarpa*, F. M., Q.L.; *C. xylocarpa*, Cunn., N.S.

W., Q.L.; *C. nervosa*, F. M., N.S.W., Q.L.; *C. Bidwillii*, Benth., Q.L.; *C. grandissima*, F. M., Q.L.; *C. pyriformis*, F. M., Q.L.; *C. anodonta*, F. M., N.S.W., Q.L.; *C. lentiscifolia*, Pers., N.S.W.; *C. exangulata*, F. M., Q.L.; *C. tenax*, F. M., N.S.W.; *C. distylis*, F. M., N.S.W.; *C. lachnocarpa*, F. M., Q.L.; *C. Alphandiana*, F. M., Q.L.; *C. Martyana*, F. M., Q.L.; *C. diphyllostegia*, F. M., Q.L.; *Nephelium semiglaucum*, M., N.S.W., Q.L.; *N. connarum*, F. M., N.S.W., Q.L.; *N. subdentatum*, F. M., N.S.W.; *N. tomentosum*, F. M., N.S.W., Q.L.; *N. coriaceum*, Benth., Q.L.; *N. foveolatum*, F. M., N.S.W., Q.L.; *N. leiocarpum*, F. M., V., N.S.W., Q.L.; *N. Beckleri*, Benth., N.S.W.; *N. divaricatum*, F. M., N.S.W., Q.L.; *N. Leichhardtii*, F. M., Q.L.; *Heterodendron oleifolium*, Desf., W.A., S.A., V., N.S.W., Q.L., C.A.; *Sapindus Australis*, Benth., Q.L.; *Atalaya salicifolia*, Bl., N.A.; *A. multiflora*, Benth., Q.L.; *A. hemiglauca*, F. M., N.S.W., Q.L., N.A.; *Harpullia alata*, F. M., N.S.W.; *H. Hillii*, F. M., N.S.W., Q.L.; *H. Leichhardtii*, F. M., N.A.; *H. Wadsworthii*, F. M., Q.L.; *H. pendula*, Planch., N.S.W., Q.L.; *Akania Hillii*, J. Hook., N.S.W., Q.L.

CELASTRINEÆ.

Hedraianthera porphyropetala, F. M., Q.L.; *Euonymus Australianus*, F. M., Q.L.; *Celastrus Australis*, Harv. & Muell., V., N.S.W., Q.L.; *C. dispermus*, F. M., N.S.W., Q.L.; *C. bilocularis*, F. M., N.S.W., Q.L.; *C. pittosporus*, F. M., Q.L.; *C. Cunninghami*, F. M., N.S.W., Q.L., N.A.; *Gymnosporia montana*, W. and A., Q.L.; *Denhamia obscura*, Meissn., Q.L., N.A.; *D. pittosporoides*, F. M., Q.L.; *Elæodendron Australe*, Vent., N.S.W., Q.L.; *Siphonodon Australis*, Benth., N.S.W., Q.L.

RHAMNACEÆ.

Ventilago viminalis, Hook., N.S.W., Q.L., N.A.; *Zizyphus jujuba*, Lam., Q.L.; *Z. quadrilocularis*, F. M., N.A.; *Gouania Australiana*, F. M., Q.L.; *Rhamnus Vitiensis*, Benth., Q.L.; *Colubrina Asiatica*, Brogn., Q.L., N.A.; *Alphitonia excelsa*, Reiss., N.S.W., Q.L., N.A.; *Emmenosperma alphitonoides*, F. M., N.S.W., Q.L.; *Pomaderris grandis*, F. M., W.A.; *P. elliptica*, Lab., T., V., N.S.W.; *P. apetala*, Lab., T., V., N.S.W.; *P. betulina*, Cunn., V., N.S.W.; *P. subrepanda*, F. M., V.; *Trymalium albicans*, Reiss., W.A.; *T. Billardierii*, Fenzl., W.A.

URTICÆÆ.

Laportea gigas, Wedd., N.S.W., *L. photinifolia*, Wedd., Q.L.; *Pipturus propinquus*, Wedd., N.S.W., Q.L.; *Epicarpurus orientalis*, Blume., N.S.W., Q.L.; *Celtis Philippinensis*, Blanco., Q.L.; *C. ingens*, F. M., N.S.W. Q.L.; *C. strychnoides*, Planch., Q.L., N.A.; *Sponia aspera*, Decaisne, V., N.S.W., Q.L., N.A.; *Morus Brunoniana*, Endl., N.S.W., Q.L.; *M. Calcar Galli*, Cunn., N.S.W., Q.L.; *Malvaisia Cunninghamsii*, Pl., Q.L.; *Ficus stipulata*, Thunb., Q.L.; *F. leucotricha*, Miq., N.A.; *F. macrophylla*, Desf., N.S.W., Q.L.; *F. Muellerae*, Miq., N.S.W.; *F. Leichhardtii*, Miq., Q.L.; *F. platypoda*, Cunn., W.A., N.S.W., Q.L., N.A., C.A.; *F. rubiginosa*, Vent., N.S.W., Q.L.; *F. puberula*, Miq., N.A.; *F. nesophila*, F. M., N.A.; *F. vitellina*, F. M., N.A.; *F. lachnoculon*, Miq., N.A.; *F. psychotriifolia*, Miq., Q.L.; *F. Fraseri*, Miq., Q.L.; *F. brachypoda*, Miq., N.S.W., Q.L., N.A.; *F. eugenioides*, F. M., N.A.; *F. pilosa*, Reinw., N.A.; *F. squamellosa*, Miq., N.S.W.; *F. Backhousii*, Miq., N.S.W.; *F. nitida*, Thunb., N.A.; *F. aspera*, Forst., V., N.S.W., Q.L., N.A.; *F. orbicularis*, Cunn., N.A.; *F. indecora*, Miq., N.S.W., Q.L., N.A.; *F. aculeata*, Cunn., N.A.; *F. opposita*, Miq., Q.L.; *F. Fitzalani*, Miq., Q.L.; *F. salicina*, F. M., N.A.; *F. vesca*, F. M., Q.L.; *F. magnifolia*, F. M., Q.L.

EUPHORBIACEÆ.

Actephila grandifolia, Baill., N.S.W.; *A. Mooreana*, Baill., N.S.W., Q.L.; *Antidesma paniculatum*, Roxb., N.A.; *Petalostigma quadriloculare*, F. N., N.S.W., Q.L., N.A.; *Phyllanthus Ferdinandi*, J. Müll., N.S.W., Q.L.; *Hemicyclia sepiaria*, Wight & Arn., N.S.W., Q.L., N.A.; *Bridelia ovata*, Decaisne, N.S.W., Q.L.; *Cleistanthus Cunninghamsii*, J. Müll., N.S.W., Q.L.; *Croton stigmatosus*, F. M., N.S.W., Q.L.; *C. tomentellus*, F. M., N.A.; *C. Verreauxii*, Baill., N.S.W., Q.L.; *C. insularis*, Baill., Q.L.; *C. Arnhemicus*, J. Müll., Q.L., N.A.; *Aleurites trilobata*, Forst., Q.L.; *Claxylon Australe*, Baill., V., N.S.W., Q.L.; *Acalypha nemorum*, F. M., N.S.W., Q.L.; *Baloghia lucida*, Endl., N.S.W., Q.L.; *Codiaeum chrysosticton*, Spreng., Q.L.; *Macaranga Tanarius*, J. Müll., Q.L.; *Mallotus claoxyloides*, J. Müll., N.S.W., Q.L.; *M. nesophilus*, J. Müll., Q.L.; *M. Philippinensis*, J. Müll., N.S.W., Q.L., N.A.; *Excaecaria Agallogha*, L., Q.L., N.A.; *Carumbium Sieberi*, J. Müll., V., N.S.W., Q.L.

LEGUMINOSÆ.

Jacksonia scoparia, Sm., N.S.W., Q.L.; *J. thesioides*, Cunn., N.A.; *Viminaria denudata*, Sm., W.A., S.A., V., N.S.W., Q.L.; *Pultenea altissima*, F. M., V., N.S.W.; *Goodia latifolia*, Salisb., W.A., S.A., T., V., N.S.W.; *Sesbania grandiflora*, Pers., N.A.; *Erythrina Vespertilio*, Benth., Q.L., N.A.; *E. Indica*, L., Q.L., N.A.; *Sophora tomentosa*, L., N.S.W., Q.L.; *Castanospermum Australe*, Cunn., N.S.W., Q.L.; *Barkleya syringifolia*, F. M., Q.L.; *Peltophorum ferrugineum*, Benth., N.A.; *Cassia Brewsteri*, F. M., Q.L.; *Tamarindus Indica*, L., N.A.; *Bauhinia Leichhardtii*, F. M., N.A., C.A.; *B. Carronii*, F. M., Q.L.; *B. Hookeri*, F. M., Q.L., N.A.; *Cynometra ramiflora*, L., Q.L.; *Erythrophlæum Laboucherii*, F. M., Q.L., N.A., C.A.; *Adenanthera Pavonina*, L., Q.L.; *A. abrosperma*, F. M., Q.L.; *Acacia Peuce*, F. M., S.A.; *A. papyrocarpa*, Benth., S.A.; *A. verniciflua*, Cunn., S.A., T., V., N.S.W.; *A. leprosa*, Sieb., V., N.S.W.; *A. dodonæifolia*, Wendl., S.A.; *A. Gnidium*, Benth., Q.L.; *A. Sentis*, F. M., S.A., V., N.S.W., Q.L., C.A.; *A. fasciculifera*, F. M., Q.L.; *A. falcata*, Willd., N.S.W., Q.L.; *A. penninervis*, Sieb., T., V., N.S.W., Q.L.; *A. retinodes*, Schlecht., S. A., V.; *A. neriifolia*, Cunn., N.S.W., Q.L.; *A. salingna*, Wendl., W.A.; *A. cyanophylla*, Lindl., W.A.; *A. pycnantha*, Benth., S. A., V.; *A. notabilis*, F. M., S.A., N.S.W.; *A. salicina*, Lindl., W.A., S.A., V., N.S.W., Q.L., N.A., C.A.; *A. rostellifera*, Benth., W.A.; *A. lunata*, Sieb., V., N.S.W., Q.L.; *A. pravisima*, F. M., V., N.S.W.; *A. supporosa*, F. M., V., N.S.W.; *A. Simsii*, Cunn., Q.L., N.A.; *A. homalophylla*, Cunn., S.A., V., N.S.W.; *A. pendula*, Cunn., N.S.W., Q.L.; *A. stenophylla*, Cunn., S.A., V., N.S.W., Q.L., N.A., C.A.; *A. hemignosta*, F. M., N.A.; *A. Melanoxyton*, Br., S.A., T., V., N.S.W.; *A. implexa*, Benth., V., N.S.W., Q.L.; *A. harpophylla*, Benth., Q.L.; *A. excelsa*, Benth., Q.L.; *A. complanata*, Cunn., N.S.W., Q.L.; *A. binervata*, Cand., N.S.W.; *A. latescens*, Benth., N.A.; *A. Dallachiana*, F. M., V.; *A. longifolia*, W., S.A., T., V., N.S.W., Q.L.; *A. cyperophylla*, F. M., Q.L., C.A.; *A. doratoxyton*, Cunn., N.S.W., Q.L.; *A. acuminata*, Benth., W.A.; *A. delibrata*, Cunn., N.A.; *A. torulosa*, Benth., Q.L., N.A.; *A. julifera*, Benth., Q.L.; *A. Solandri*, Benth., Q.L.; *A. leptostachya*, Benth., Q.L.; *A. glaucescens*, Willd., N.S.W., Q.L.; *A. Cunninghamsii*.

Hook., N.S.W., Q.L.; *A. pachycarpa*, F. M., N.A.; *A. tumida*, F. M., N.A.; *A. crassocarpa*, Cunn., Q.L., N.A.; *A. auriculiformis*, Cunn., Q.L.; *A. elata*, Cunn., N.S.W.; *A. discolor*, Willd., T., V., N.S.W.; *A. decurrens*, Willd., S.A., T., V., N.S.W.; *A. pallida*, F. M., N.A.; *Pithecolobium lophanthum*, F. M., W. A.; *P. Thozetii*, F. M., Q.L.; *P. procerum*, F. M., Q.L.; *P. canescens*, F. M., Q.L.; *P. pruinatum*, Benth., N.S.W., Q.L.; *P. moniliferum*, Benth., N.A.; *P. Tozerii*, F. M., N.S.W., Q.L.; *P. Hendersonii*, F. M., N.S.W., Q.L.; *Archidendron Vaillantii*, F. M., Q.L.

MYRTACEÆ.

Calycotrix arborescens, F. M., N.A.; *Thryptomene oligandra*, F. M., Q.L., N.A.; *Astartea fasciculata*, Endl., W.A.; *Agonis juniperina*, Schauer, W.A.; *A. flexuosa*, Schauer, W.A.; *Leptospermum lævigatum*, F. M., S.A., T., V., N.S.W., Q.L.; *L. flavescens*, Sm., T., V., N.S.W., Q.L.; *L. lanigerum*, Sm., S.A., T., V., N.S.W.; *Kunzea peduncularis*, F. M., V., N.S.W.; *K. corifolia*, Reichenb., T., V., N.S.W.; *Callistemon speciosus*, Cand., W.A.; *C. lanceolatus*, Cand., V., N.S.W., Q.L.; *C. salignus*, Cand., S.A., T., V., N.S.W., Q.L.; *C. brachyandrus*, Lindl., S.A., V., N.S.W.; *Lamarchea hakeifolia*, Gaud., W.A.; *Melaleuca decussata*, Br., S.A., V.; *M. acacioides*, F. M., N.A.; *M. pauciflora*, Turcz., N.S.W.; *M. squarrosa*, Sm., S.A., T., V., N.S.W.; *M. linariifolia*, Sm., N.S.W., Q.L.; *M. leucodendron*, L., N.S.W., Q.L., N.A.; *M. lasiandra*, F. M., N.A.; *M. genitifolia*, Sm., N.S.W., Q.L., N.A.; *M. stypheloides*, Sm., N.S.W.; *M. parviflora*, Lindl., W.A., S.A., V.; *M. armillaris*, Sm., V., N.S.W.; *M. raphiophylla*, Schauer, W.A.; *M. cuticularis*, Lab., W.A.; *M. globifera*, Br., W.A.; *M. nodosa*, Sm., N.S.W., Q.L.; *M. ericifolia*, Sm., S.A., T., V., N.S.W.; *M. minutifolia*, F. M., N.A.; *Angophora cordifolia*, Cav., N.S.W.; *A. subvelutina*, F. M., N.S.W., Q.L.; *A. intermedia*, Cand., V., N.S.W., Q.L.; *A. lanceolata*, Cav., N.S.W., Q.L.; *Eucalyptus stellulata*, Sieb., V., N.S.W.; *E. coriacea*, Cunn., T., V., N.S.W.; *E. virgata*, Sieb., V., N.S.W.; *E. amygdalina*, Lab., T., V., N.S.W.; *E. coccifera*, Hook, T.; *E. obliqua*, L'Her., S.A., T., V., N.S.W.; *E. rigida*, Sieb., N.S.W.; *E. capitellata*, Sm., N.S.W.; *E. santalifolia*, F. M., S.A.; *E. macrorrhyncha*, F. M., V., N.S.W.; *E. piperita*, Sm., V., N.S.W.; *E.*

pilularis, Sm., V., N.S.W., Q.L.; *E. marginata*, Sm., W.A.; *E. Leucoxydon*, F. M., S.A., V., N.S.W.; *E. melliodora*, A. C., V., N.S.W.; *E. gracilis*, F. M., W.A., S.A., V., N.S.W.; *E. paniculata*, Sm., N.S.W.; *E. fasciculosa*, F. M., S.A., V., N.S.W.; *E. hæmastoma*, Sm., N.S.W., Q.L.; *E. microcorys*, F. M., N.S.W., Q.L.; *E. pruinosa*, Schauer, N.A.; *E. oligantha*, Schauer, N.A.; *E. polyanthemus*, Schauer, V., N.S.W., Q.L., N.A.; *E. Behriana*, F. M., S.A., V., N.S.W.; *E. largiflorens*, F. M., S.A., V., N.S.W., Q.L.; *E. odorata*, Behr., S.A.; *E. uncinata*, Turcz., W.A., S.A., V., N.S.W.; *E. hemiphloia*, F. M., N.S.W., Q.L.; *E. stricta*, Sieb., N.S.W.; *E. decipiens*, Endl., W.A.; *E. corynocalyx*, F. M., S.A.; *E. albens*, Miq., V., N.S.W.; *E. Bowmanii*, F. M., Q.L.; *E. siderophloia*, Benth., V.S.W., Q.L.; *E. melanophloia*, F. M., N.S.W., Q.L.; *E. drepanophylla*; F. M., Q.L., N.A.; *E. trachyphloia*, F. M., Q.L.; *E. leptophleba*, F. M., Q.L., N.A.; *E. crebra*, F. M., N.S.W., Q.L., N.A.; *E. brachypoda*, Turcz., W.A., S.A., N.S.W., N.A., C.A.; *E. brachyandra*, F. M., N.A.; *E. pulverulenta*, Sims., N.S.W.; *E. globulus*, Lab., T., V.; *E. longifolia*, Link and Otto, V., N.S.W.; *E. conoidea*, Benth., W.A.; *E. urnigera*, J. Hook, T.; *E. miniata*, Cunn., N.A.; *E. robusta*, Sm., N.S.W.; *E. botryoides*, Sm., V., N.S.W., Q.L.; *E. goniocalyx*, F. M., V., N.S.W.; *E. gomphocephala*, Cand., W.A.; *E. megacarpa*, F. M., W.A.; *E. cornuta*, Labill., W.A.; *E. platypus*, Hook, *E. macrandra*, F. M., W.A.; *E. occidentalis*, Endl., W.A.; *E. pallidifolia*, F. M., N.A.; *E. viminalis*, Labill., S.A., T., V., N.S.W.; *E. rostrata*, Schl., W.A., S.A., V., N.S.W., Q.L., N.A., C.A.; *E. tereticornis*, Sm., V., N.S.W., Q.L.; *E. platyphylla*, F. M., Q.L., N.A.; *F. tectifera*, F. M., N.A.; *E. Stuartiana*, F. M., S.A., T., V., N.S.W.; *E. patellaris*, F. M., N.A.; *F. rudis*, Endl., W.A.; *E. saligna*, Sm., N.S.W.; *E. resinifera*, Sm., N.S.W., Q.L.; *E. pellita*, F. M., Q.L.; *E. Gunnii*, J. Hook, T., V.; *E. patens*, Benth., W.A.; *E. concolor*, Schauer, W.A.; *E. decurva*, F. M., W.A.; *E. aspera*, F. M., N.A.; *E. grandifolia*, Br., N.A.; *E. clavigera*, Cunn., N.A.; *E. tessellaris*, F. M., Q.L., N.A.; *E. phœnicea*, F. M., N.A.; *E. colossea*, F. M., W.A.; *E. loxophleba*, Benth., W.A.; *E. fœcunda*, Schauer, W.A.; *E. redunca*, Schauer, W.A.; *E. ferruginea*, Schauer, N.A.; *E. setosa*, Schauer, Q.L., N.A.; *E. melissiodora*, Lindl., Q.L.; *E. latifolia*,

F. M., N.A.; *E. ptychocarpa*, F. M., N.A.; *E. calophylla*, Br., W.A.; *E. ficifolia*, F. M., W.A.; *E. corymbosa*, Sm., V., N.S.W., Q.L.; *E. citriodora*, Hook., N.S.W., Q.L.; *E. terminalis*, F. M., Q.L., N.A.; *E. dichromophloia*, F. M., N.A.; *E. apiophora*, F. M., N. A.; *E. maculata*, Hook., S.N.W., Q.L.; *E. eximia*, Schauer, N.S.W.; *E. erythrocorys*, F. M., W.A.; *E. tetragona*, F. M., W.A.; *E. tetrodonta*, F. M., W.A.; *Tristania neriifolia*, Br., M.S.W.; *T. suaveolens*, Sm., N.S.W., Q.L., N.A.; *T. conferta*, Br., N.S.W., Q.L., N.A.; *T. lactiflora*, F. M., N.A.; *T. exiliflora*, F. M., Q.L.; *T. laurina*, Br., V., N.S.W., Q.L.; *T. psidioides*, Cunn., N.A.; *T. umbrosa*, Cunn., N.A.; *Metrosideros glomulifera*, Sm., N.S.W., Q.L.; *M. leptopetala*, F. M., N.S.W., Q.L.; *M. ternifolia*, F. M., Q.L.; *M. eucalyptoides*, F. M., N.A.; *M. chrysantha*, F. M., Q.L.; *M. paradoxa*, F. M., N.A.; *Backhousia myrtifolia*, Hook. & Harv., N.S.W., Q.L.; *B. augustifolia*, F. M., Q.L.; *B. sciadophora*, F. M., N.S.W., Q.L.; *B. citriodora*, F. M., Q.L.; *Myrtus Tozerii*, F. M., N.S.W., Q.L.; *M. rhytisperma*, F. M., N.S.W., Q.L.; *M. gonoclada*, F. M., Q.L.; *M. Hillii*, Benth., Q.L.; *M. Bidwillii*, Benth., Q.L.; *M. ramulosa*, Benth., Q.L.; *M. acmenoides*, F. M., N.S.W., Q.L.; *Myrtus fragrantissima*, F. M., N.S.W., Q.L.; *M. sessiliflora*, F. M., Q.L.; *M. melastomoides*, F. M., N.S.W., Q.L.; *M. argentea*, Hill, N.S.W., Q.L.; *M. elachantha*, F. M., N.S.W., Q.L.; *M. macrocarpa*, F. M., Q.L.; *Eugenia Smithii*, Poir., V., N.S.W., Q.L., N.A.; *E. Ventenatii*, Benth., N.S.W., Q.L.; *E. leptantha*, Wight, Q.L.; *E. jambolana*, Lam., N.S.W., Q.L.; *E. cormiflora*, F. M., Q.L.; *E. Tierneyana*, F. M., Q.L.; *E. grandis*, Wight, Q.L.; *E. suborbicularis*, Benth., Q.L.; *E. Wilsonii*, F. M., Q.L.; *E. eucalyptoides*, F. M., Q.L.; *E. angophoroides*, F. M., Q.L.; *E. Armstrongii*, Benth., N.A.; *E. oleosa*, F. M., Q.L.; *E. Dal-lachyana*, F. M., Q.L.; *E. jucunda*, F. M., Q.L.; *Barringtonia (areya)*, F. M., Q.L., N.A.; *B. speciosa*, L. Fil., Q.L.; *B. acutangula*, Gaertn., Q.L.

CHRYSOBALANEÆ.

Parinariium Nonda, F. M., Q.L., N.A.; *P. Griffithianum*, Benth., Q.L., N.A.

SAXIFRAGÆÆ.

Quintinia Sieberi, A. Cand., N.S.W.; *Q. Verdonii*, F. M., N.S.W.; *Polyosma Cunninghamsi*, Br., N.S.W.; *Anopterus*

Macleayana, F. M., N.S.W., Q.L.; *A. glandulosa*, Lab., T.; *Callicoma serratifolia*, Andr., N.S.W., Q.L.; *C. Stutzerii*, F. M., Q.L.; *Anodopetalum biglandulosum*, Cunn., T.; *Aphanopetalum resinosum*, Endl., V., N.S.W., Q.L.; *Ceratopetalum gum-miferum*, Sm., N.S.W.; *C. apetalum*, D. Don, N.S.W.; *Schizomeria ovata*, D. Don, N.S.W.; *Davidsonia pruriens*, F. M., Q.L.; *Gillbeea adenopetala*, F. M., Q.L.; *Weinmannia paniculosa*, F. M., N.S.W.; *W. rubifolia*, Benth., N.S.W.; *W. Benthami*, F. M., N.S.W.; *W. Biagiana*, F. M., Q.L.; *Tetracarpæa Tasmanica*, J. Hook., T.; *Eueryphia Billardierii*, Spach, T.; *E. Moorei*, F. M., N.S.W.

LYTHRACEÆ.

Pemphis acidula, Forst., Q.L., N.A.; *Sommeratia acida*, L., Q.L., N.A.

RHIZOPHOREÆ.

Rhizophora mucronata, Lam., Q.L., N.A.; *Ceriops Candolleana*, Arn., Q.L., N.A.; *Bruguiera Rheedei*, Blume., Q.L., N.A.; *B. gymnorrhiza*, Lam., Q.L., N.A.; *Carallia integrifolia*, Cand., Q.L., N.A.

COMBRETACEÆ.

Terminalia platyptera, F. M., N.A.; *T. volucris*, Br., N.A.; *T. oblongata*, F. M., Q.L.; *T. bursarina*, F. M., N.A.; *T. circumalata*, F. M., N.A.; *T. pterocarpa*, F. M., N.A.; *T. Thozettii*, Benth., Q.L.; *T. melanocarpa*, F. M., Q.L., N.A.; *T. Muelleri*, Benth., Q.L.; *T. latipes*, Benth., N.A.; *T. edulis*, F. M., N. A.; *T. discolor*, F. M., N.A.; *T. porphyrocarpa*, F. M., Q.L.; *T. platyphylla*, F. M., N.A.; *T. petiolaris*, Cunn., N.A.; *T. erythrocarpa*, F. M., N.A.; *T. grandiflora*, Benth., N.A.; *Lumnitzera racemosa*, Willd., Q.L., N.A.; *L. coccinea*, Wight and Arn., Q.L.; *Macropteranthes montana*, F. M., Q.L.; *M. Kekwickii*, F. M., N.A.; *M. Leichhardtii*, F. M., Q.L.; *Gyrocarpus Jacquinii*, Roxb., Q.L., N.A.

LAURINEÆ.

Cinnamomum Laubatii, F. M., Q.L.; *Cryptocarya glaucescens*, Br., N.S.W., Q.L.; *C. microneura*, Meissn., N.S.W., Q.L.; *C. patentinervis*, F. M., N.S.W., Q.L.; *C. obovata*, Br., N.S.W.; *C. obtusifolia*, F. M., N.S.W., Q.L.; *C. Mackinnoniana*, F. M., Q.L.; *C. hypospodia*, F. M., N.S.W., Q.L.; *C. Meissneri*, F. M., N.S.W.; *C. hypoglauca*, Meissn., Q.L.; *C. Murrayi*, F. M.,

Q.L.; *Caryodaphne Browniana*, Nees, N.S.W., Q.L.; *C. Australis*, A. Br., N.S.W., Q.L.; *Endiandra virens*, F. M., N.S.W., Q.L.; *E. Muelleri*, Meissn., N.S.W., Q.L.; *E. glauca*, Br., Q.L.; *E. Sieberi*, Nees., N.S.W., Q.L.; *E. hypotephra*, F. M., Q.L.; *Litsæa dealbata*, Nees., N.S.W., Q.L.; *Tetranthera laurifolia*, Jacq., Q.L.; *T. Bindoniana*, F.M., Q.L.; *T. Fawcettiana*, F. M., N.S.W., Q.L.; *T. reticulata*, Meissn., Q.L.; *T. ferruginea*, Br., Q.L.

HERNANDIÆ.

Hernandia peltata, Meissn., Q.L.

SAMYDACEÆ.

Homalium Vitiense, Benth., Q.L.; *H. brachybotrys*, F. M., Q.L., N.A.; *Casearia Dellachii*, F. M., Q.L.; *C. esculenta*, Roxb., Q.L.

UMBELLIFERÆ.

Astrotriche floccosa, Cand., N.S.W., Q.L.; *Panax palmaceus*, F. M., V., N.S.W., Q.L.; *P. mollis*, Benth., Q.L.; *P. Macgillivrayi*, Benth., Q.L.; *P. sambucifolius*, Sieb., T., V., N.S.W.; *P. cephalobotrys*, F. M., N.S.W.; *P. elegans*, Moore and Muell., N.S.W., Q.L.; *Mackinlaya macrosciadea*, F. M., Q.L.; *Hedera Australiana*, F. M., Q.L.; *Heptopleurum venulosum*, Seem., Q.L.; *Brassaia actinophylla*, Endl., Q.L.

II.—SYNPETALÆ.

CORNACEÆ.

Marlea Vitiensis, Benth., N.S.W., Q.L.

CAPRIFOLIACEÆ.

Sambucus xanthocarpa, F. M., V., N.S.W., Q.L.

RUBIACEÆ.

Sarcocephalus cordatus, Miq., Q.L., N.A.; *Gardenia edulis*, F. M., N.A.; *G. resinosa*, F. M., N.A.; *G. pyriformis*, Cunn., N.A.; *G. megasperma*, F. M., N. A.; *G. Macgillivrayi*, Benth., Q.L.; *G. ochreatea*, F. M., N.S.W., Q.L.; *G. Jardinei*, F. M., Q.L.; *G. Fitzalani*, F. M., Q.L.; *Webera Dallachiana*, F. M., Q.L.; *Diplospora Australis*, Benth., Q.L.; *Ixora Pavetta*, Roxb., Q.L.; *I. tomentosa*, Roxb., Q.L.; *I. Timorensis*, Cand., N.A.; *I. Beckleri*, Benth., N.S.W.; *Timonius Rumphii*, Cand., Q.L., N.A.; *Antirrhœa tenniflora*, F. M., Q.L.; *Hodgkinsonia ovatiflora*, F.

M., N.S.W., Q.L.; *Canthium lucidum*, Hook. and Arn., N.S.W., Q.L., N.A.; *C. oleifolium*, Hook., N.S.W., Q.L., N.A., C.A.; *C. coprosmoides*, F. M., N.S.W., Q.L., N.A.; *Psychotria nesophila*, F. M., Q.L., N.A.; *Coprosma microphylla*, Cunn., T., V., N.S.W.

LORANTHACEÆ.

Nuytsia floribunda, Br., W.A.

ELÆAGNEÆ.

Elæagnus latifolia, L., Q.L.

SANTALACEÆ.

Exocarpus latifolia, Br., Q.L., N.A.; *E. cupressiformis*, Lab., S.A., V., N.S.W., Q.L.; *E. pendula*, F. M., S.A., V., N.S.W.; *E. dasystachys*, Schl., S.A., V., N.S.W.; *E. glandulacea*, Miq., W.A.; *Santalum lanceolatum*, Br., Q.L., N.A., C.A.; *S. acuminatum*, A. Cand., S.A., V., N.S.W.; *S. persicarium*, F. M., S.A., V., N.S.W.; *S. cygnorum*, Miq., W.A.; *S. obtusifolium*, Br., N.S.W.

PROTEACEÆ.

Cenarrhenes nitida, Lab., T.; *Persoonia arborea*, F. M., V.; *P. longifolia*, Br., W.A.; *P. linearis*, Br., V., N.S.W.; *P. laureola*, Lindl., W.A.; *Adenanthos sericea*, Lab., W.A.; *A. apiculata*, Br., W.A.; *Grevillea heliosperma*, Br., N.A.; *G. Alphonsiana*, F. M., C.A.; *G. pyramidalis*, Cunn., N.A.; *G. robusta*, Cunn., N.S.W., Q.L.; *G. refracta*, Br., N.A.; *G. Leucodendron*, Cunn., N.A.; *G. Crysodendron*, Br., N.S.W., Q.L., N.A.; *G. Sturtii*, Br., C.A.; *G. polystachya*, Br., Q.L., N.A.; *G. striata*, Br., Q.L., N.A., C.A.; *G. lineata*, Br., C.A.; *G. mimosoides*, Br., N.A., C.A.; *G. Hilceratophylla*, Br., N.A.; *G. longiloba*, F. M., N.A.; *G. lii*, F. M., Q.L.; *G. Bleasdalii*, F. M., Q.L.; *G. diversifolia*, Meissn., W.A.; *Hakea lorea*, Br., N.A., C.A.; *H. longifolia*, Cunn., N.A.; *H. stricta*, F. M., S.A., V., N.S.W.; *H. saligna*, Kn. and Sal., N.S.W.; *H. eriantha*, Br., V., N.S.W.; *H. arborescens*, Br., N.A.; *H. eucalyptoides*, Meissn., W.A.; *Xylome-lum Scottianum*, F. M., Q.L.; *X. pyriforme*, Sm., N.S.W.; *X. occidentale*, Br., W.A.; *Helicia ternifolia*, F. M., N.S.W., Q.L.; *H. glabriflora*, F. M., N.S.W., Q.L.; *H. Youngiana*, Moore and Muell., N.S.W., Q.L.; *H. conjunctiflora*, F. M., N.S.W., Q.L.; *H. præalta*, F. M., N.S.W., Q.L.; *H. ferruginea*, F. M., N.S.

W., Q.L.; *Orites excelsa*, Br., N.S.W., Q.L.; *Telopea oreades*, F. M., V.; *Cardwellia sublimis*, F. M., Q.L.; *Lomatia Fraseri*, Br., V., N.S.W., Q.L.; *L. polymorpha*, Br., T.; *Stenocarpus sinuosus*, Endl., N.S.W., Q.L.; *S. salignus*, Br., N.S.W., Q.L.; *S. acacioides*, F. M., N.A.; *S. concolor*, F. M., Q.L.; *Banksia Cunninghamsi*, Sieb., V., N.S.W.; *B. ericifolia*, L. fil., N.S.W.; *B. litoralis*, Br., W.A.; *B. cylindrostachya*, Lindl., W.A.; *B. Australis*, Br., S.A., T., V., N.S.W.; *B. integrifolia*, L. fil., V., N.S.W., Q.L.; *B. verticillata*, Br., W.A.; *B. attenuata*, Br., W.A.; *B. elatior*, Br., Q.L.; *B. prionotes*, Lindl., W.A.; *B. Menziesii*, Br., W.A.; *B. serrata*, L. fil., T., V., N.S.W.; *B. dentata*, L. fil., Q.L., N.A.; *B. Solandri*, Br. W.A.; *B. grandis*, Willd., W.A.; *B. Victoriae*, Meissn., W.A.; *B. elegans*, Meissn., W.A.; *B. Brownii*, Baxt., W.A.; *B. ilicifolia*, Br., W. A.

COMPOSITÆ.

Aster argophyllus, Lab., T., V., N.S.W.; *A. stellulatus*, Lab., T., V., N.S.W., Q.L.; *Senecio Bedfordii*, F. M., T., V., N.S.W.

STYRACEÆ.

Symplocos Thwaitesii, F. M., N.S.W., Q.L.; *S. Stawellii*, F. M., Q.L.

ERICACEÆ.

Prionotes cerinthoides, Br., T.; *Richea pandanifolia*, J. Hook., T.; *Epacris heteronema*, Lab., T.; *Cystanthe procera*, F. M., T.; *Leucopogon Richei*, Br., W.A., S.A., T., V., N.S.W., Q.L.; *Monotoca elliptica*, Br., V., N.S.W., Q.L.; *M. lineata*, Br., T. V.; *Trochocarpa laurina*, Br., N.S.W., Q.L.

MYRSINÆÆ.

Ægiceras fragrans, Kœnig, N.S.W., Q.L., N.A.; *Myrsine variabilis*, Br., V., N.S.W., Q.L.; *M. porosa*, F. M., Q.L.; *M. subsessilis*, F. M., N.S.W., Q.L.; *Ardisia pseudo-jambosa*, F. M., Q.L.; *Mæsa dependens*, F. M., Q.L.; *M. haplobotrys*, F. M., Q.L.

SAPOTÆÆ.

Sersalisia cotinifolia, F. M., N.S.W., Q.L.; *S. sericea*, Br., Q. L., N.A.; *S. obovata*, Br., Q.L.; *Achras Australis*, Br., N.S.W., Q.L.; *A. Pohlmaniana*, F. M., Q.L.; *Mimusops parvifolia*, Br., Q.L., A.A.; *M. kauki*, L., Q.L.

EBENACEÆ.

Diospyros rugosula, Br., N.A.; *D. mabacea*, F. M., N.S.W., Q.L.; *D. megalocarpa*, F. M., N.A.; *D. fasciculosa*, F. M., N.S.W., Q.L.; *D. cupulosa*, F. M., Q.L.; *D. sericocarpa*, F. M., Q.L.; *D. Cargillia*, F. M., N.S.W., Q.L.; *D. pentamera*, Woolls and Muell., N.S.W., Q.L.; *D. humilis*, F. M., Q.L., N.A.; *D. geminata*, F. M., Q.L.

OLEACEÆ.

Olea paniculata, Br., N.S.W., Q.L.; *Chionanthus axillaris*, Br., Q.L.; *Notelæa ligustrina*, Vent., T., V., N.S.W.

VERBENACEÆ.

Clerodendron tomentosum, Br., N.S.W., Q.L.; *C. lanceolatum*, F. M., N.A.; *Vitex trifolia*, L., N.S.W., Q.L., N.A.; *V. acuminata*, Br., Q.L.; *V. lignum vitæ*, Cunn., N.S.W., Q.L.; *V. Leichhardtii*, F. M., N.S.W., Q.L.; *V. macrophylla*, Br., Q.L.; *V. melicopea*, F. M., Q.L.; *V. glabrata*, Br., Q.L.; *Faradaya splendida*, F. M., Q.L.; *Premna acuminata*, Br., N. A.; *P. Tracyana*, F. M., Q.L.; *Avicennia officinalis*, L., W.A., S.A., V., N.S.W., Q.L., N.A.; *Myoporum insulare*, Br., S.A., T., V., N.S.A.; *M. platycarpum*, Br., S.A., V., N.S.W.; *M. Cunninghami*, Benth., S.A., V., N.S.W.; *Eremophila bignoniflora*, F. M., V., N.S.W., Q.L., C.A.; *E. Mitchellii*, Benth., N.S.W., Q.L., C.A.; *E. alternifolia*, Br., S.A., V., N.S.W.; *E. oppositifolia*, Br., S.A.; V., N.S.W.; *E. longifolia*, F. M., W.A., S.A., V., N.S.W., Q.L., C.A.

LABIATÆ.

Prostanthera lasianthos, Lab., T., V., N.S.W.

ASPERIFOLIÆ.

Ehretia saligna, Br., N.A.; *E. acuminata*, Br., N.S.W., Q.L.; *E. membranifolia*, Br., Q.L.; *E. pilosula*, F. M., Q.L.; *Cordia dichotoma*, Forst., Q.L., N.A.

ACANTHACEÆ.

Earlia excelsa, F. M., Q.L.

BIGNONIACEÆ.

Diplanthera tetraphylla, Banks & Sol., Q.L.; *Dolichandra heterophylla*, Fenzl., Q.L., N.A.; *D. filiformis*, Fenzl., N.A.

APOCYNÆÆ.

Tabernæmontana orientalis, Br., N.S.W., Q.L.; *Lactaria calocarpa*, Hassk., Q.L.; *L. Moorei*, F. M., N.S.W., Q.L.; *Alstonia constricta*, F. M., N.S.W., Q.L.; *A. scholaris*, Br., Q.L.; *A. ophioxyloides*, F. M., Q.L., N.A.; *Wrightia pubescens*, Br., N. A.; *Balfouria saligna*, Br., Q.L., N.A., C.A.

LOGANIACEÆ.

Geniostoma Australianum, F. M., Q.L.

SOLANÆÆ.

Duboisia myoporoides, Br., N.S.W., Q.L.; *Solanum verbascifolium*, L., N.S.W., Q.L.

III.—AMENTACEÆ.

CASUARINÆ.

Casuarina glauca, Sieb., S.A., V., N.S.W.; *C. obesa*, Miq., W.A.; *C. torulosa*, Ait., N.S.W.; *C. quadrivalvis*, Lab., S.A., T., V., N.S.W.; *C. Cunninghamsi*, Miq., N.S.W.; *C. Huegeliana*, Miq., W.A.; *C. trichodonta*, Miq., W.A.; *C. suberosa*, Otto and Dietr., S.A., V., N.S.W.; *C. equisetifolia*, Forst., N.S.W., Q.L., N.A.; *C. leptoclada*, Miq., V., N.S.W.; *C. thujoides*, Miq., W.A.; *C. Decaisneana*, F. M., C.A.; *C. tenuissima*, Sieb., V., N.S.W., Q. L.; *C. Drummondii*, Miq., W.A.; *C. microstachya*, Miq., W.A.

CUPULIFERÆ.

Fagus Cunninghami, Hook., T., V.; *F. Gunnii*, J. Hook., T.; *F. Moorei*, F. M., N.S.W.

CONIFERÆ.

Araucaria Cunninghami, Ait., N.S.W., Q.L.; *A. Bidwilli*, Hook., Q.L.; *A. Greyi*, F. M., N.A.; *Athrotaxis cupressoides*, Don., T.; *A. selaginoides*, Don., T.; *Callitris Macleayana*, F. M., N.S.W.; *C. Parlatorei*, F. M., N.S.W., Q.L.; *C. Actinostrobus* F. M., W.A.; *C. cupressiformis*, Vent., T., V., N.S.W.; *C. columellaris*, F. M., N.S.W., Q.L.; *C. Endlicheri*, Parl., V., N.S. W., Q.L.; *C. Gunnii*, J. Hook., T., N.S.W.; *C. verrucosa*, Br., W.A., S.A., T., V., N.S.W., Q.L., N.A., C.A.; *Daerydium Franklinii*, J. Hook., T.; *Podocarpus elata*, Br., N.S.W., Q.L.;

P. Drouyniana, F. M., W.A.; *P. spinulosa*, Br., N.S.W.; *P. alpina*, Br., T., V., N.S.W.; *Phyllocladus rhomboidalis*, Rich., T.; *Ephedra arborea*, F. M., Q.L., N.A.

CYCADEÆ.

Zamia Fraseri, Miq., W.A.; *Z. Denisonii*, F. M., N.S.W., Q. L.; *Cycas media*, Br., Q.L.

MONOCOTYLEDONEÆ.

PANDANÆÆ.

Pandanus pedunculatus, Br., N.S.W., Q.L.; *P. spiralis*, Br., N.A.; *P. aquaticus*, F. M., N.A.

KINGIACEÆ.

Kingia Australis, Br., W.A.

PALMÆ.

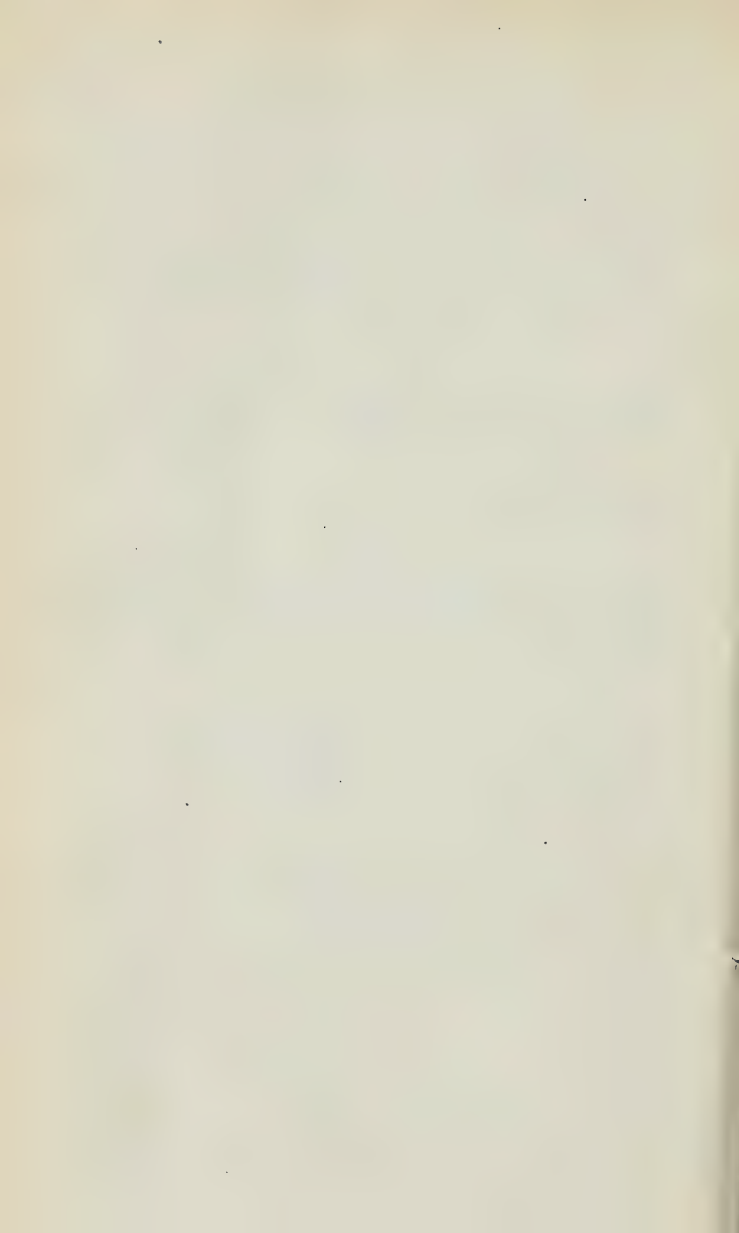
Cocos nucifera, L., Q.L.; *Caryota urens*, L., Q.L., N.A.; *Ptychosperma Seaforthia*, Miq., N.S.W., Q.L.; *P. Alexandræ*, F. M., Q.L.; *Livistona Australis*, Mart., V., N.S.W., Q.L.; *L. inermis*, Br., N.A.

ACOTYLEDONEÆ.

FILICES.

Alsophila Leichhardtii, F. M., N.S.W.; *A. Australis*, Br., T., V., N.S.W., Q.L.; *Cyathea medullaris*, Sm., V.; *C. Lindsayana*, Hook., Q.L.; *Dicksonia antarctica*, Lab., S.A., T., V., N.S.W., Q.L.

The Monocotyledonous and Acotyledonous trees, not actually furnishing timber for ordinary purposes, might have been excluded. *Gomphandra Australiana*, F. M., among Oleoinea, from Queensland, was casually omitted.



THE
PRINCIPAL TIMBER TREES
READILY ELIGIBLE FOR
VICTORIAN INDUSTRIAL CULTURE,

*with indications of their native countries and some of
their technologic uses.*

AN ENUMERATION OFFERED BY

F E R D . V O N M U E L L E R ,
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of the Acclimation Society of Victoria.

This enumeration originated in a desire of the writer to place before his fellow-colonists a succinct list of those trees which, in our geographic latitudes, can be grown to advantage. Calls for such information arose gradually in the department of the Botanic Garden of Melbourne, not merely because it impressed itself more and more on the mind of every thoughtful settler that the wanton waste of the native forests should be checked, but that also largely should be added to our timber riches by means of copious and multifarious introductions from abroad, and that for these introductions the widest possible scope should be allow-

ed. Nevertheless, this list is far from claiming completeness, either as a specific index or as a series of notes on the principal technologic applicability of the trees most accessible. Indeed, it may be regarded simply as a precursor of larger essays, such as the intended forest administration will gradually call forth. Meanwhile, however, this brief explanatory catalogue may facilitate locally that information which hitherto was afforded by the author's correspondence chiefly.

It seemed beyond the scope of this writing to tabulate the trees here enumerated, in reference to climatic regions. The inhabitant of colder and moister mountains in this colony, or the settler in the hotter and more arid tracts of country, can readily foresee, from the brief geographic notes given with each tree, which kind should be chosen for the spot selected by him for wood-culture; but if doubts in this respect should arise, the needful advice will readily be offered by the writer.

Though this list was originally prepared and alluded to as an appendage to a lecture* recently delivered at the Melbourne Industrial Museum, I was honored by my colleagues of the Council of the Acclimation Society in their giving publicity to this document along with their last annual report, the Society being quite as anxious to foster the introduction and multiplication of industrial plants as the continued acquisition and diffusion of foreign animals of utilitarian importance.

Unquestionably, also, the periodical issue of essays on animals and plants, to be introduced or to be dif-

* The Application of Phytology to the Industrial Purposes of Life.

fused, will give additional strength to the Society's labors.

Should, therefore, this small literary offer prove acceptable to the supporters of the Victorian Acclimation Society, then the writer would feel sufficiently encouraged to offer, in a similar form, a list of other plants, recommendable here for more general cultivation ; and, although such indices only to some extent contain original research, they are likely to bring together information more condensed and more recent than would be attainable in costly or voluminous works of even several languages, and yet such treating, perhaps, of countries with far narrower climatic zones than ours.

Possibly this publication may aid us also to render known our colonial requirements thus far abroad, while it will offer, likewise, some information to speed interchanges.

For our Industrial Museum and such similar institutions as doubtless, ere long, on a limited scale, will be connected with each Mechanics' Institute, this unpretentious treatise may help to explain the real wealth which we possess in our unfortunately almost unguarded forests, or point out the manifold new treasures which we should raise independently in our woodlands, while also these pages might stimulate both public and private efforts to provide, by timely thoughtfulness, those increased timber resources without which the next generations of this land can be neither hale nor prosperous.

I.—CONIFEROUS TREES.

Araucaria Bidwilli, Hook.—Bunya-Bunya. Southern Queensland. A tree one hundred and fifty feet in height, with a fine-grained, hard, and durable wood; the seeds are edible.

Araucaria Brasiliensis, A. Rich. — Brazilian Pine. A tree, one hundred feet high, producing edible seeds. Ought to be tried in our fern gullies.

Araucaria Cookii, R. Br.—In New Caledonia, where it forms large forests. Height of tree, two hundred feet.

Araucaria Cunninghamsi, Ait.—Moreton-Bay Pine. East Australia, between fourteen degrees and thirty-five degrees S. latitude. The tree gets one hundred and thirty feet high. The timber is used for ordinary furniture.

Araucaria excelsa, R. Br.—Norfolk Island Pine.—A magnificent tree, sometimes two hundred and twenty feet high, with a stem attaining ten feet in diameter. The timber is useful for ship-building and many other purposes.

Araucaria imbricata, Pav.—Chile and Patagonia. The male tree attains only a height of fifty feet, but the female reaches one hundred and fifty feet. It furnishes a hard and durable timber, as well as an abundance of edible seeds, which constitute a main article of food of the natives. Eighteen good trees will yield enough for a man's sustenance all the year round. In our lowlands of comparative slow growth, but likely of far more rapid development, if planted in our ranges.

Callitris quadrivalvis, Vent. — North Africa. A middling-sized tree, yielding the true Sandarac resin.

Cephalotaxus Fortunei, Hook.—China and Japan. This splendid yew attains a height of sixty feet, and is very hardy.

Cryptomeria Japonica, Don.—Japan and Northern China. A slender evergreen tree, one hundred feet high. It requires forest valleys for successful growth. The wood is compact, very white, soft and easy to work.

Cupressus Benthami, Endl.—Mexico, at five to seven thousand feet. A beautiful tree, sixty feet high. The wood is fine-grained and exceedingly durable.

Cupressus Lawsoniana, Murr. (*Chamæcyparis Lawsoniana*, Parl.)—Northern California. This is a splendid red-flowered cypress, growing one hundred feet high, with a stem of two feet in diameter, and furnishes a valuable timber for building purposes, being clear and easily worked.

Cupressus Lindleyi, Klotzsch.—On the mountains of Mexico. A stately cypress, up to one hundred and twenty feet high. It supplies an excellent timber.

Cupressus macrocarpa, Hartw. (*C. Lambertiana*, Gord.)—Upper California. This beautiful and shady tree attains the height of one hundred and fifty feet, with a stem of nine feet in circumference, and is one of the quickest-growing of all conifers, even in poor, dry soil.

Cupressus Nutkaensis, Lamb. (*Chamæcyparis Nutkaensis*, Spach.)—North-west America. Height of tree one hundred feet. Wood used for boat-building and other purposes; the bast for mats and ropes.

Cupressus obtusa, F. von Muell. (*Retinospora obtusa*, S. & Z.)—Japan. Attains a height of eighty feet; stem five feet in circumference. It forms a

great part of the forests at Nipon. The wood is white-veined and compact, assuming, when planed, a silky lustre. It is used in Japan for temples. There are varieties of this species with foliage of a golden and of a silvery-white hue.

Two other Japanese cypresses deserve introduction, namely : *Cupr. breviramea* (*Chamœcyparis breviramea*, Maxim.), and *Cupr. pendens*, (*Chamœcyparis pendula*, Maxim.).

Cupressus pisifera, F. von Muell. (*Chamœcyparis pisifera*, S. & Z.)—Japan. It attains a height of thirty feet, producing also a variety with golden foliage.

Cupressus sempervirens, L.—Common Cypress of South Europe. Height of tree up to eighty feet. It is famous for the great age it reaches, and for the durability of its timber, which is next to imperishable. At present it is much sought for the manufacture of musical instruments.

Cupressus thurifera, Humb. B. & K. — Mexico ; three thousand to four thousand five hundred feet above sea-level. A handsome pyramidal tree, upward of forty feet high.

Cupressus thuyoides, Linne. (*Chamœcyparis sphaeroidea*, Spach.)—White Cedar of North America ; in moist or morassy ground. Height of tree eighty feet ; diameter of stem three feet. The wood is light, soft, and fragrant ; it turns red when exposed to the air.

Cupressus torulosa, Don.—Nepal Cypress. Northern India ; four thousand five hundred to eight thousand feet above sea-level. Height of tree one hundred and fifty feet ; circumference of stem, as much as sixteen feet. The reddish, fragrant wood is as

durable as that of the Deodar Cedar, highly valued for furniture. The tree seems to prefer the limestone soil.

Dacrydium cupressinum, Soland.—New Zealand. Native name, *Rimu*; the Red Pine of the colonists. This stately tree acquires the height of two hundred feet, and furnishes a hard and valuable wood. With other New Zealand conifers particularly eligible for our forest valleys. A most suitable tree for cemeteries, on account of its pendulous branches.

Dacrydium Franklini, Hook., fil.—Huon Pine of Tasmania; only found in moist forest recesses, and might be planted in our dense fern-tree gullies. Height of tree one hundred feet; stem-circumference twenty feet. The wood is highly esteemed for ship-building and various artisan's work.

Dammara alba, Rumph. (*D. orientalis*, Lamb.)—Agath Dammar. Indian Archipelagos and mainland. A large tree, one hundred feet high, with a stem of eight feet in diameter; straight and branchless for two thirds its length. It is of great importance on account of its yield of the transparent Dammar resin, extensively used for varnish.

Dammara Australis, Lamb.—Kauri Pine. North island of New Zealand. This magnificent tree measures, under favorable circumstances, one hundred and eighty feet in height, and seventeen feet in diameter of stem; the estimated age of such a tree being seven hundred or eight hundred years. It furnishes an excellent timber for furniture, masts of ships, or almost any other purpose; it yields, beside, the Kauri resin of commerce, which is largely got from under the stem of the tree. The greatest part is gathered

by the Maories in localities formerly covered with Kauri forests; pieces, weighing one hundred pounds, have been found in such places.

Dammara macrophylla, Lindl.—Santa Cruz Archipelagus. A beautiful tree, one hundred feet high, resembling *D. alba*.

Dammara Moorei, Lindl.—New Caledonia. Height of tree about fifty feet.

Dammara obtusa, Lindl.—New Hebrides. A fine tree, two hundred feet high; with a long, clear trunk; resembling *D. Australis*.

Dammara ovata, Moore.—New Caledonia. This tree is rich in Dammar resin.

Dammara robusta, Moore.—Queensland Kauri. A tall tree, known from Rockingham's Bay and Wide Bay. It thrives well even in open, exposed, dry localities at Melbourne.

Dammara Vitiensis, Seem.—In Fiji. Tree one hundred feet high; probably identical with Lindley's *D. longifolia*.

Fitzroya Patagonica, Hooker, fil.—Southern parts of Patagonia and Chile. A stately tree, one hundred feet high, up to fourteen feet in diameter of stem. The wood is red, almost imperishable in the open air or under ground; it does not warp, and is easy to split. It comes into commerce in boards seven feet long, eight inches wide, one half inch thick, and is used for roofing, deals, doors, casks, etc. The outer bark produces a strong fibre used for caulking ships. Like many other trees of colder regions, it would require here to be planted in our mountain forests.

Frenela Actinostrobis, Muell. (*Actinostrobis pyramidalis*, Miq.)—From S. W. Australia. Though only

a shrub, is placed here on record as desirable for introduction, because it grows on saline, desert flats, where any other conifers will not readily succeed. It may become important for coast cultivation.

Frenela Macleayana, Parl.—New South Wales. A handsome tree of regular pyramidal growth, attaining a height of seventy feet; the timber is valuable.

Frenela verrucosa, A. Cunn.—Also several other species from Victoria and other parts of Australia are among the trees which may be utilized for binding the coast and desert sand. They all exude Sandarac.

Ginkgo biloba, L. (*Salisburia adiantifolia*, Smith.)—Ginkgo-tree. China and Japan. A deciduous fan-leaved tree, one hundred feet high, with a straight stem twelve feet in diameter. The wood is white, soft, easy to work, and takes a beautiful polish. The seeds are edible, and when pressed yield a good oil. Ginkgo trees are estimated to attain an age of three thousand years.

Juniperus Bermudiana, L.—The Pencil Cedar of Bermuda and Barbadoes. This species grows sometimes ninety feet high, and furnishes a valuable red durable wood, used for boat-building, furniture, and particularly for pencils, on account of its pleasant odor and special fitness. Many of the plants called *Thuya* or *Biotia Meldensis*, in gardens, belong to this species.

Juniperus brevifolia, Antoine.—In the Azores up to four thousand eight hundred feet; a nice tree, with sometimes silvery foliage.

Juniperus Cedrus, Webb.—A tall tree of the higher mountains of the Canary Islands.

Juniperus Chinensis, L.—In temperate regions of the Himalaya, also in China and Japan. This tree

is known to rise seventy-five feet. Probably identical with the Himalayan Pencil Cedar (*Juniperus religiosa*, Royle); it is remarkable for its reddish, close-grained wood.

Juniperus communis, L.—One of the three native coniferæ of Britain, attaining under favorable circumstances a height of nearly fifty feet; of medicinal uses; the berries also used in the preparation of gin.

Juniperus drupacea, Labill.—Plum Juniper. A very handsome, long-leaved Juniper, the Habel of Syria. It attains a height of thirty feet, and produces a sweet, edible fruit, highly esteemed throughout the Orient.

Juniperus excelsa, Bieberst.—In Asia Minor, two to six thousand feet above the sea-level. A stately tree, sixty feet high.

Juniperus flaccida, Schlecht.—In Mexico, five to seven thousand feet high. A tree of thirty feet in height, rich in a resin similar to Sandarach.

Juniperus foetidissima, Willd.—A tall, beautiful tree in Armenia and Tauria, five thousand to six thousand five hundred feet.

Juniperus Mexicana, Schiede.—Mexico at an elevation of seven thousand to eleven thousand feet. A straight tree, ninety feet high, stem three feet in diameter, exuding copiously a resin similar to Sandarach.

Juniperus occidentalis, Hook.—North California and Oregon, at five thousand feet. A straight tree, eighty feet high, with a stem of three feet diameter.

Juniperus Phœnicea, L.—South Europe and Orient. A small tree, twenty feet high, yielding an aromatic resin.

Juniperus procera, Hochst.—In Abyssinia. A stately tree, furnishing a hard, useful timber.

Juniperus recurva, Hamilton.—On the Himalayas, ten to twelve thousand feet high. A tree attaining thirty feet in height.

Juniperus sphaerica, Lindl.—North China. A handsome tree, forty feet high.

Juniperus Virginiana, L.—North American Pencil Cedar or Red Cedar. A handsome tree, fifty feet high, supplying a fragrant timber, much esteemed for its strength and durability; the inner part is of a beautiful red color, the outer is white; it is much used for pencils.

Libocedrus Chilensis, Endl.—In cold valleys on the southern Andes of Chile, two thousand to five thousand feet. A fine tree, eighty feet high, furnishing a hard, resinous wood of a yellowish color.

Libocedrus decurrens, Torr.—White Cedar of California, growing on high mountains. Attains a height of fully two hundred feet, with a stem twenty-five feet in circumference.

Libocedrus Doniana, Endl.—North island of New Zealand, up to six thousand feet elevation. A forest tree one hundred feet high, stem three feet and more in diameter. The wood is hard and resinous, of a dark reddish color, fine-grained, excellent for planks and spars.

Libocedrus tetragona, Endl.—On the Andes of North Chile, two thousand to five thousand feet. This species has a very straight stem, and grows one hundred and twenty feet high. The wood is quite white, and highly esteemed for various artisans' work; indeed, very precious.

Nageia (*Podocarpus*) *amara*, Blume. —Java, on high volcanic mountains. A large tree, sometimes two hundred feet high.

Negeia (*Podocarpus*) *cupressina*, R. Br. —Java and Philippine Islands. Height of tree one hundred and eighty feet, furnishing a highly valuable timber.

Nageia (*Podocarpus*) *dacrydioides*, A. Rich. — In swampy ground of New Zealand; the "Kahikatea" of the Maories, called White Pine by the colonists. Height of tree one hundred and fifty feet; diameter of stem four feet. The white, sweet fruit is eaten by the natives; the wood is pale, close-grained, heavy, and, among other purposes, used for building canoes.

Nageia (*Podocarpus*) *ferruginea*, Don. — Northern parts of New Zealand. The Black Pine of the colonists; native name "Miro." Height of tree eighty feet; it produces a dark-red resin, of a bitter taste; the wood is of a reddish color, very hard.

Nageia (*Podocarpus*) *Lamberti*, Klotzsch. —Brazils. A stately tree, yielding valuable timber.

Nageia (*Podocarpus*) *Purdieana*, Hook. —Jamaica, at two thousand and five hundred to three thousand five hundred feet. This quick-growing tree attains a height of one hundred feet.

Nageia (*Podocarpus*) *spicata*, Br. — Black Rue of New Zealand. Tree eighty feet high; wood pale, soft, close, and durable.

Nageia (*Podocarpus*) *Thunbergii*, Hook. — Cape of Good Hope. A large tree, known to the colonists as "Geelhout;" it furnishes a splendid wood for building.

Nageia (*Podocarpus*) *Totara*, Don. — New Zealand. A fine tree, one hundred and twenty feet high, with

a stem of twenty feet in circumference ; it is called Mahogany Pine by the colonists. The reddish, close-grained, and durable wood is valuable both for building and for furniture, and is also extensively used for telegraph-posts ; it is considered the most valuable timber of New Zealand. Many other tall timber-trees of the genus *Podocarpus* or *Nageia* occur in various parts of Asia, Africa, and America, doubtless all desirable, but the quality of their timber is not well known, though likely in many cases excellent. *Nageia* is by far the oldest published name of the genus.

Phyllocladus rhomboidalis, Rich. — Celery Pine of Tasmania. A stately tree, up to sixty feet high, with a stem of two to six feet in diameter. The timber is valuable for ships' masts. It will grow to advantage only in deep forest valleys.

Phyllocladus trichomanoides, Don. — Celery Pine of New Zealand, northern island ; it is also called Pitch-pine by the colonists. The tree attains a height of seventy feet, with a straight stem of three feet in diameter, and furnishes a pale, close-grained timber, used particularly for spars and planks ; the Maories employ the bark for dyeing red and black.

Pinus Abies, Du Roi. (*Pinus picea*, Linne.) — Silver Fir, Tanne. In Middle Europe, up to 50° N. Lat., forming dense forests. A fine tree, already the charm of the ancients, attaining two hundred feet in height, and twenty feet in circumference of stem, reaching the age of three hundred years. It furnishes a most valuable timber for building, as well as furniture, and, in respect to lightness, toughness, and elasticity, it is even more esteemed than the Norway Spruce, but is not so good for fuel or for charcoal. It

also yields a fine white resin and the Strassburg turpentine, similar to the Venetian.

Pinus Abies, var. *Cephalonica*, Parlatores. (*Pinus Cephalonica*, Endl.)—Greece, three to four thousand feet above the sea. A tree sixty feet high, with a stem circumference of ten feet. The wood is very hard and durable, and much esteemed for building.

Pinus Abies, var. *Nordmanniana*, Parlatores. (*P. Nordmanniana*, Steven.)—Crimea and Circassia, six thousand feet above the sea. This is one of the most imposing firs, attaining a height of one hundred feet, with a perfectly straight stem. It furnishes a valuable building timber. The Silver Fir is desirable for our mountain forests.

Pinus Alba, Ait.—White Spruce. From Canada to Carolina, up to the highest mountains. It resembles *P. picea*, but is smaller, at most fifty feet high. Eligible for our alpine country.

Pinus Alcocquiana, Parlatores.—Japan, at an elevation of six to seven thousand feet. A fine tree, with very small, blue-green leaves; the wood is used for light household furniture.

Pinus amabilis, Dougl.—California Silver Fir. North Carolina, at an elevation of four thousand feet. A handsome fir, two hundred feet high, circumference of stem twenty-four feet; the stem is naked up to one hundred feet.

Pinus Australis, Michx.—Southern or Swamp Pine. Also called Georgia, Yellow, Pitch or Broom Pine, in the Southern States of North America. The tree attains a height of seventy feet. It furnishes a good timber for furniture and building. It is this tree which forms chiefly the extensive pine-barrens of the

United States, and yields largely the American turpentine.

Pinus Ayacahuite, Ehrenb. (*P. Loudoniana*, Gord.) — In Mexico, at an elevation of eight thousand to twelve thousand feet. An excellent pine, one hundred to one hundred and fifty feet high, with a stem diameter of three to four feet, yielding a much-esteemed white or sometimes reddish timber.

Pinus balsamea, L. — Balsam Fir, Balm of Gilead Fir. Canada, Nova Scotia, New England. An elegant tree, forty feet high, which, with *Pinus Fraseri*, yields the Canada Balsam, the well-known oleo-resin. The timber is light, soft, and useful for furniture. It thrives best in cold, swampy places. Eligible for our alps.

Pinus Canadensis, L. — Hemlock Spruce. In Canada and over a great part of the United States, on high mountains. A very ornamental tree, one hundred feet high, with a white, cross-grained, and inferior wood. The tree, however, is extremely valuable on account of its bark, which is much esteemed as a tanning material; it is stripped off during the Summer months. The young shoots are used for making spruce beer.

Pinus Canariensis, C. Smith. — Canary Pine. Canary Islands, forming large forests at an elevation of five to six thousand feet. A tree seventy feet high, with a resinous, durable, very heavy wood, not readily attacked by insects. It thrives well in Victoria, and shows celerity of growth.

Pinus Cedrus, L. — Cedar of Lebanon. Together with the Atlas variety on the mountains of Lebanon and Taurus, also in N. Africa. The tree grows to a

height of one hundred feet, and attains a very great age; the wood is of a light-reddish color, soft, easy to work, and much esteemed for its durability.

Pinus Cedrus var. *Deodara*.—Deodar Cedar. On the Himalaya mountains, four to twelve thousand feet above sea level. A majestic tree, one hundred and fifty feet high, and sometimes thirty feet in circumference of stem. The wood is of a whitish yellow color, very close-grained and resinous, and furnishes one of the best building timbers known; it must, however, not be felled too young. The tree also yields a good deal of resin and turpentine.

Pinus Cembra, L.—On the European Alps, also in Siberia and Tartary. The tree attains a height of sixty feet; the wood is of a yellow color, very soft and resinous, of an extremely fine texture, and is extensively used for carving and cabinet work. The seeds are edible, and, when pressed, yield a great quantity of oil. A good turpentine is also obtained from this pine.

Pinus cembroides, Zucc. (*P. Laveana*, Schiede and Deppe.)—Mexican Swamp Pine. A small tree, thirty feet high, growing at an elevation of eight thousand to ten thousand feet. The timber is not of much use, but the seeds are edible, and have a very agreeable taste.

P. Cilicica, Ant. and Kotsch.—Cilician Silver Fir. Asia Minor. Four thousand to six thousand five hundred above sea-level. A handsome tree of pyramidal growth, one hundred and sixty feet high. The wood is very soft, and used extensively for the roofs of houses, as it does not warp.

Pinus contorta, Dougl.—On high, damp ranges in

California, attaining fifty feet in height. It is valuable as a shelter-tree in stormy localities.

Pinus Coulteri, Don. — California, on the eastern slope of the coast range, at an elevation of three thousand to four thousand feet. A pine of quick growth, attaining a height of seventy-five feet; it has the largest cones of all pines.

Pinus Douglasii, Sabine. — Oregon Pine. N. W. America, forming very extensive forests. A large conical-shaped tree, up to three hundred feet in height, with a stem of two to ten feet in diameter. Only in a moist forest climate of rapid growth.

Pinus dumosa, Don (*P. Brunoniana* Wall). — Bootan, Sikkim, and Nepal, ten thousand feet above sea-level. A very ornamental fir, rising to seventy or eighty feet.

Pinus excelsa, Wall. — The Lofty or Bootan Pine. Himalaya, forming large forests at from six thousand to eleven thousand five hundred feet elevation. A fine tree, one hundred and fifty feet high, furnishing a valuable, close-grained, resinous wood, as well as a good quantity of turpentine.

Pinus Fortunei, Parlatore — China, in the neighborhood of Foochowfoo. A splendid tree, seventy feet high, somewhat similar in habit to *P. Cedrus*.

Pinus Fraseri, Pursh. — Double Balsam Fir. On high mountains of Carolina and Pennsylvania. This tree, which gets about twenty feet high, yields, with *P. Balsamea*, Canada Balsam.

Pinus Geradiana, Wall. — Nepal Nut Pine. In the N. E. parts of the Himalaya, at an elevation of ten thousand to twelve thousand feet, forming extensive forests. The tree gets fifty feet high, and produces very sweet, edible seeds, also turpentine.

Pinus grandis, Dougl.—Great Silver Fir of North California. A splendid fir, two hundred feet high, and upward, growing best in moist valleys of high ranges ; the wood is white and soft.

Pinus Halepensis, Mill. — Aleppo Pine. South Europe and North Africa. This well-known pine attains a height of eighty feet, with a stem of from four to five feet in diameter. The timber of young trees is white, of older trees of a dark color ; it is principally esteemed for ship-building, but also used for furniture. The tree yields a kind of Venetian turpentine, as well as a valuable tar. It thrives well in waterless, rocky places, also on the sandy sea-coast. *P. maritima* is a variety of this species. Content with the poorest and driest localities, and rapid of growth.

Pinus Hartwegii, Lindl.—Mexico, nine thousand to thirteen thousand feet above sea-level. A pine, fifty feet in height, with a very durable wood of a reddish color ; it yields a large quantity of resin.

Pinus Larix, L.—Common Larch ; deciduous. On the European Alps up to seven thousand feet. It attains a height of one hundred feet, sometimes rising even up one hundred and sixty feet, and produces a valuable timber of great durability, which is used for land and water buildings, and much prized for ship-building. The bark is used for tanning and dyeing. The tree is of great importance for its yield of the Venetian turpentine, which is obtained by boring holes into it in Spring ; these fill during the Summer, supplying from one half to three fourths pint of turpentine. In Piedmont, where they tap the tree in different places, and let the liquid continually run, it is said that from seven to eight may be obtained in

a year, but the wood suffers through this operation. *P. L.* var. *Rossica*, Russian Larch, grows principally on the Altai mountains, from two thousand five hundred to five thousand five hundred feet above sea level; it attains a height of eighty feet. The species would be important for our upland country.

Pinus leiophylla, Schiede and Deppe.—Seven thousand to eleven thousand feet up on the mountains of Mexico. A tree ninety feet high. The wood is excessively hard.

Pinus leptolepis, Sieb and Zucc.—Japan Larch. In Japan, between thirty-five degrees and forty-eight degrees north latitude, up to an elevation of nine thousand feet. The timber is highly valued by the Japanese.

Pinus longifolia, Roxb.—Emodi Pine, or Cheer Pine. On the Himalaya mountains, from two thousand to seven thousand feet. A handsome tree, with a branchless stem of fifty feet; the wood is resinous, and the red variety useful for building; it yields a quantity of tar and turpentine. The tree stands exposure and heat well.

Pinus Massoniana, Lamb (*P. Sinensis*, Lamb).—China and Japan. This pine attains a height of sixty feet, and supplies a resinous, tough, and durable wood, used for buildings and furniture. The roots, when burned with the oil of *Brassica Orientalis*, furnish the Chinese Lampblack.

Pinus Menziesii, Dougl.—North-west America. A very handsome tree, which grows to a height of seventy feet, and furnishes a valuable timber; it thrives best in moist ground.

Pinus Hudsonica, Poir (*P. Banksiana*, Lamb).—

Grey Pine ; North America, up to sixty-four degrees north latitude. Height of tree, forty feet ; in the cold north only a shrub. The wood is light, tough, and easily worked.

Pinus Jeffreyi, Murr.—North California, on a sterile, sandy soil. A noble pine, one hundred and fifty feet high ; stem four feet thick.

Pinus Kaempferi, Lamb.—Chinese Larch; also called Golden Pine. China. This is the handsomest of all the larches. It is of quick growth, and attains a height of one hundred and fifty feet. The leaves, which are of a vivid green during Spring and Summer, turn to a golden yellow in Autumn. The wood is very hard and durable.

Pinus Koraiensis, Sieb. and Zucc. — China and Japan. A handsome tree, thirty to forty feet high, producing edible seeds.

Pinus Lambertiana, Dougl.—Giant or Sugar Pine. North-west coast of America; mostly in great altitudes. A lofty tree, upward of three hundred feet high, with a straight, naked stem of from twenty to sixty feet in circumference. It thrives best in sandy soil, and produces a soft, white, straight-grained wood, which for inside work is esteemed above any other Pine in California, and furnished in large quantities. The cones are eighteen inches long; the seeds are edible, and used as food by the natives. Would come best to perfection in the humid regions of our higher mountains.

Pinus Laricio, Poir.—Corsican Pine. South Europe. It attains a height of one hundred and twenty feet. The wood is white, toward the centre dark, very resinous, coarse-grained, elastic, and durable,

and much esteemed for building, especially for water-works. There are three main varieties of this pine, viz.: *P. L. Poiretiana*, in Italy; *P. L. Austriaca*, in Austria; *P. L. Pallassiana*, on the borders of the Black Sea. The tree grows best in calcareous soil, but also in poor, sandy soil, where, however, the timber is not so large nor so good. It yields all the products of *P. Silvestris*, but in greater quantities, being perhaps the most resinous of all pines.

Pinus Mertensiana, Bong. — California Hemlock Spruce. North-west America. The wood is white and very soft, but is often used for building. The tree is from one hundred to one hundred and fifty feet high, by a stem diameter of four to six feet.

Pinus mitis, Michx. — Yellow Pine of North America. In dry sandy soil, attaining a height of sixty feet. Wood durable, fine-grained, moderately resinous, valuable for flooring.

Pinus monophylla, Torr. and Frem. — Stone or Nut Pine of California, on the Sierra Nevada and Cascade Mountains, six thousand five hundred feet. The seeds are edible, of an almond-like taste, and consumed in quantity by the natives. Height of tree only thirty-five feet; thickness of stem eight to ten inches.

Pinus montana, Du Roi. (*P. Pumilio* Hænke.) — On the Alps and Carpathians up to the highest points, covering large tracts, and thriving on the poorest soil. The tree, which grows about twenty-five feet high, in favorable localities fifty, yields much oil of turpentine. The wood is used for carving and for firewood. Only available to advantage for our highlands.

Pinus Montezumæ, Lamb. (*P. Devoniana*, Lindl.)

(*P. Grenvilleæ*, Gord.).—Mexico. A handsome pine, eighty feet high ; wood white, soft, and resinous.

Pinus monticola, Dougl.—California, at an elevation of seven thousand feet. It thrives best in poor soil of granite formation, and attains the height of two hundred feet, with a stem of one and one half to four feet thick. The wood is white, close-grained.

Pinus muricata, Don.—Bishop's Pine. California. Found up seven thousand five hundred feet. This pine grows to about forty feet.

Pinus nigra, Ait.—Black Spruce. North-east America. Occurring extensively between forty-four degrees and fifty-three degrees N. latitude. This tree, which is termed Double Spruce by the Canadians, attains a height of seventy feet, and furnishes a light, elastic timber of white color, excellent for yards of ships. The young shoots are used for making spruce-beer, and the small roots serve as cords. It likes swampy forest land.

Pinus nobilis, Dougl.—Noble White Fir. North-west coast of America, on the Columbia River and the mountains of north California, where it forms extensive forests at six to eight thousand feet. A majestic tree, one hundred and fifty to two hundred feet high, with regular, horizontal branches. It furnishes a valuable timber for building.

Pinus orientalis, L.—Sapindus Fir. In Asia Minor, at four thousand feet. The tree rises to about eighty feet, and resembles somewhat the Norway Spruce. The wood is exceedingly tough and durable.

Pinus parviflora, Sieb.—In Japan. It only gets to be about twenty-five feet high ; but is much used as an avenue tree ; wood for fine furniture and boat-building.

Pinus Pattoniana, Parl. — California ; five to six thousand feet above sea-level. A very fine fir, three hundred feet high, with a perfectly straight stem. The wood is hard, of a reddish color, with handsome veins ; but poor in resin.

Pinus patula, Schiede and Deppe. — In Mexico ; at an elevation of eight to nine thousand feet. A graceful pine, eighty feet high.

Pinus pendula, Soland. (*P. microcarpa*, Lamb). — Small-coned American Larch ; Black Larch or Tamarack. Frequent in Vermont and New Hampshire. A pine of pyramidal growth, one hundred feet high. The timber is white, heavy, resinous, and as highly valued as that of the Common Larch.

Pinus picea, Du Roi (*P. Abies*, L.). — Norway Spruce, Fichte. Middle and Northern Europe and Northern Asia ; rising from the plains to an elevation of four thousand five hundred feet, and forming extensive forests. The tree attains a height of one hundred and fifty feet, or even more, and furnishes an excellent timber for building and furniture ; commonly known under the name of White Deal. It also produces the Burgundy Pitch in quantity, while the bark is used for tanning. Though enduring our dry Summers, this spruce would have to be restricted for timber purposes to the damp mountains.

Pinus Pinaster, Soland. — Cluster Pine. On the shores of the Mediterranean. The tree is of quick growth, and rises to sixty feet in height ; the wood is soft and resinous ; it yields largely the French turpentine. Among the best pines for consolidation of sandy coast land, and converting rolling sands into pasture and agricultural land. For ease of rearing

and rapidity of growth, one of the most important of all pines.

Pinus Pinceana, Gord. —Mexico, up to nine thousand feet above sea level. A very remarkable pine, having drooping branches like the Weeping Willow; sixty feet high. Most desirable for cemeteries.

Pinus Pindrow, Royle. —In great abundance on the spurs of the Himalaya mountains, eight to twelve thousand feet above the sea-level. A fine, straight-stemmed tree, one hundred feet high.

Pinus Pinea, L. —Stone Pine. Frequent in the countries bordering on the Mediterranean; height of tree sixty feet; the wood is whitish, light, but full of resin, and much used for buildings, furniture, and ships. The seeds are edible, somewhat resembling almonds, but of a taste resinous, though not disagreeable; they only ripen in their third year. This pine grows as easily, and almost as quickly as the Cluster Pine.

Pinus Pinsapo, Boiss. —Spanish Fir. In Spain, on the Sierra Nevada, four to six thousand feet. A tree of sixty feet high, with branches from the ground.

Pinus ponderosa, Dougl. (*P. Benthamiana*, Hartw.). —Yellow or Pitch-pine of the mountains of N. W. America. Height of tree up to two hundred and twenty-five feet, with a stem of twenty-four feet in circumference, of comparatively quick growth; the wood is heavy, and for general purposes preferred to that of any other pine. Has proved well-adapted even for dry localities in Victoria.

Pinus Pseudo - Strobus, Lindl. —In Mexico. This tree is superior in appearance to any other Mexican pine; height eighty feet.

Pinus Pyrenaica, Lapeyr.—In the south of Spain and on the Pyrenees. A fine ornamental tree of quick growth, eighty feet high; the wood is white and dry; poor in resin.

Pinus radiata, Don. (*P. insignis*, Dougl.)—California. A splendid pine, fully one hundred feet high, with a straight stem, two to four feet in diameter. It is of remarkably rapid growth, a seedling, one year old, being strong enough for final transplantation; the wood is tough, and much sought for boat-building and various utensils.

Pinus religiosa, Humb. —Oyamel Fir. Mexico, four to nine thousand feet above the sea-level. A magnificent tree with silvery leaves, growing one hundred feet high; stem six feet in diameter; the wood is particularly well fitted for shingles.

Pinus resinosa, Soland.—Red Pine, North America, principally in Canada and Nova Scotia. It gets eighty feet high and two feet in diameter; the wood is red, fine-grained, heavy, and durable, not very resinous, and is used for ship-building.

Pinus rigida, Mill.—American Pitch-pine. From New England to Virginia. It grows to a height of eighty feet; the timber, when from good soil, is hard and resinous and used for building; but the tree is principally important for its yield of turpentine, resin, pitch, and tar.

Pinus rubra, Lamb.—Hudson's Pine, Red Spruce. Nova Scotia, Newfoundland, and other northern parts of the American Continent. A straight, slender tree, seventy feet high; the wood is of a reddish color and highly esteemed.

Pinus Sabiniana, Dougl.—California Nut Pine or

White Pine. Most frequent on the western slopes of the Rocky Mountains, intermixed with other trees; one hundred and fifty feet high; stem three to five feet in diameter; the wood is white and soft; the clustered heavy cones attain a length of one foot; the seeds are edible. Proves in dry localities of Victoria to be of quick growth.

Pinus serotina, Michx. — Pond Pine. Southern States of North America, in black morassy soil, principally near the sea-coast; it is fifty feet high, stem eighteen inches in diameter; the wood is soft.

Pinus Silvestris, L.—Scotch Fir, Foehre. Middle and Northern Europe, up to seventy degrees N. lat., and North Asia, thriving best in sandy soil. A very valuable tree, fully one hundred feet high, growing to the age of about one hundred and twenty years. The Red Baltic, Norway, or Riga deals are obtained from this pine, as well as a large portion of the European pine tar. Proves well adapted even for the drier parts of Victoria.

Pinus Sibirica, Turcz. (*P. Pichta*, Fisch).—Siberian Pitch Fir. On the Altai Mountains; it reaches a height of fifty feet.

Pinus Strobus, L.—Weymouth Pine or American White Pine. N. E. America, growing on any soil, but preferring swampy ground; it is found one hundred and sixty feet high, with a stem of four to six feet in diameter; the wood is soft, white, light, free of knots, almost without resin, easy to work, and much esteemed for masts; it yields American turpentine and gallipot.

Pinus Tæda, L.—Frankincense or Loblolly Pine. Florida and Virginia, in sandy soil, attaining a height

of eighty feet ; the timber is esteemed for ship-building. It also yields turpentine in good quantity, though of inferior quality.

Pinus tenuifolia, Benth.—Mexico, at an elevation of five thousand feet, forming dense forests ; height of tree, one hundred feet ; stem up to five feet in diameter.

Pinus Teocote, Cham. and Schlecht. — Okote or Torch Pine. Mexico, five to eight thousand feet above the sea-level. Tree one hundred feet high, stem three to four feet in diameter ; the wood is resinous and durable.

Pinus Tsuga, Ant.—In the northern provinces of Japan, six to nine thousand feet above the sea. The tree gets only twenty-five feet high ; its timber is highly esteemed for superior furniture, especially by turners.

Pinus Webbiana, Wallich.—King Pine, Dye Pine. On the Himalaya Mountains, at an elevation of twelve to thirteen thousand feet. A splendid fir, seventy to eighty feet high, with a stem diameter of generally three to four feet, but sometimes even ten feet. The wood is of a white color, soft, coarse-grained, and very resinous ; the natives extract a splendid violet dye from the cones.

Sciadopitys verticillata, Sieb.—The lofty and curious Umbrella Fir of Japan, one hundred and forty feet high ; resists severe frosts ; wood white and compact.

Sequoia sempervirens, Endl. (*Taxodium sempervirens*, Lamb.) — Redwood or Bastard Cedar of N. W. America, chiefly California. A splendid tree, three hundred feet high, occasionally with a diameter

of the stem of fifty-five feet. The wood is reddish, close-veined, but light and brittle. One of the most colossal trees of the globe.

Sequoia Wellingtonia, Seem. (*Wellingtonia gigantea*, Lindl.)—Mammoth tree. California, up to five thousand feet above the sea. This, the biggest of all trees, attains a stem of three hundred and twenty feet in length, and one hundred and twelve feet in circumference, the oldest trees being estimated at one thousand one hundred years; the total height of a tree will occasionally be four hundred and fifty feet; a stem broken at three hundred and fifty feet had a diameter of eighteen feet. The wood is soft and white when felled, afterward it turns red.

Taxodium distichum, Rich.—Virginia Swamp, or Bald Cypress. In swampy places of North America. A large and valuable tree, one hundred feet high, with a stem circumference of sometimes forty feet, of rapid growth, with deciduous foliage, like that of the Larch and Ginkgo; it is found fossil in the miocene formation of many parts of Europe. The wood is fine-grained, hard and durable; it yields an essential oil, and a superior kind of turpentine. Useful for avenues on swampy margins of lakes or river-banks.

Taxodium mucronatum, Ten.—The famed Montezuma Cypress of Mexico, one hundred and twenty feet high, with a trunk forty-four feet in circumference; it forms extensive forests between Chapultepec and Testuco.

Taxus baccata, L.—Yew. Middle and South Europe and Asia, at one thousand to four thousand feet elevation. Generally a shrub, sometimes a tree forty feet high, which furnishes a yellow or brown wood,

exceedingly tough, elastic, and durable, and much esteemed by turners. The tree is of very slow growth, and reaches a great age, perhaps several thousand years; some ancient ones are known with a stem of fifty feet in girth.

Taxus brevifolia, Nuttall. (T. *Lindleyana*, Laws.) —North-west America. Western Yew. A stately tree, seventy-five feet high, with a stem of five feet in circumference. The Indians use the wood for their bows.

Thuja gigantea, Nutt.—North-west America, on the banks of the Columbia River. The Yellow Cypress of the colonists. A straight, graceful tree, two hundred feet high, furnishing a valuable building timber, of a pale or light yellow color.

Thuja occidentalis, L.—North America, particularly frequent in Canada. A fine tree, seventy feet high; the wood is reddish or yellowish, fine-grained, very tough, and resinous, and well fit for building, especially for water work. The shoots and also an essential oil of this tree are used in medicine; the bast can be converted into ropes.

Thuyopsis dolabrata, Sieb and Zucc. —Japan. A majestic tree, furnishing an excellent hard timber of a red color.

Torreya Californica, Torr. (T. *Myristica*, Hooker.) —In California. Tree eighty feet high.

Torreya grandis, Fortune.—China. A tree sixty feet high, with an umbrella-shaped crown; it produces good timber.

Torreya nucifera, S. and Z. (*Caryotaxus nucifera*, Zucc.) —Japan. Height of tree, about thirty feet.

From the nuts the Japanese press an oil, used as an article of food.

Torreya taxifolia, Arnott.—Florida.—A tree fifty feet in height, with a firm, close-grained, durable wood of a reddish color.

Widdringtonia juniperoides, Endl.—South Africa, three thousand to four thousand feet above sea-level. A middling sized tree, rich in resin.

II.—MISCELLANEOUS TREES, NOT CONIFEROUS.

Acacia acuminata, Benth.—A kind of Myall from Western Australia, attaining a height of forty feet.

Acacia decurrens, Willd. (*A. mollissima*, Willd. ; *A. dealbata*, Link.)—The Black Wattle, or Silver Wattle. From the eastern part of S. Australia, through Victoria and N. S. Wales, to the southern part of Queensland ; in open plains a small or middle-sized tree ; in deep forest recesses a lofty tree, of singularly rapid growth. Its wood can be used for staves and many other purposes, but its chief use would be to afford the first shelter, in treeless localities, for raising forests. Its bark, rich in tannin, and its gum, not dissimilar to Gum Arabic, render this tree also important. Other quick-growing trees, useful in various ways, growing in any soil, and enduring drought, can be used simultaneously, by mere dissemination, in plowed ground, for dense temporary belts of shelter, or for quick-yielding fuel plantations, such as *Acacia pycnantha*, *A. lophantha*, *Casuarina quadrivalvis*, *Casuarina suberosa*, *Eucalyptus melliodora*, *Eucalyptus viminalis*, and many other Eucalypts, all easily growing from seed.

Acacia homalophylla, Cunn.—The Victoria Myall, extending into the deserts of N. S. Wales. The dark brown wood is much sought for turner's work, on account of its solidity and fragrance; perhaps its most extensive use is in the manufacture of tobacco-pipes. Never a tall tree.

Acacia Melanoxyton, R. Br.—The well-known Blackwood of our river flats and moist forest valleys, passing also under the inappropriate name of Lightwood. In irrigated valleys of deep soil the tree will attain a height of eighty feet, with a stem several feet in diameter. The wood is most valuable for furniture, railway carriages, boat-building, casks, billiard tables, pianofortes (for sound-boards and actions), and numerous other purposes. The fine-grained wood is cut into veneers. It takes a fine polish, and is considered equal to the best walnut. Our best wood for bending under steam. For further details refer to the volumes of the Exhibitions of 1862 and 1867.

Acer campestre, L.—Extends from Middle Europe to North Asia. Height, forty feet, in shelter and deep soil; the yellow and purple tint of its foliage in Autumn render the tree then particularly beautiful. The wood is compact and fine-grained, and sought for choice furniture. The tree can be trimmed for hedge growth. Comparatively quick of growth, and easily raised from seed. These remarks apply to almost all kinds of maples.

Acer dasycarpum, Ehrhart.—The Silver Maple of North America. Likes rather a warmer climate than the other American maples, and therefore particularly desirable for us here. Height, fifty feet; wood pale and soft; stem sometimes nine feet in diameter.

Acer macrophyllum, Pursh.—Large Oregon Maple. Tree ninety feet high, of quick growth; stem sixteen feet in circumference; wood whitish, beautifully veined.

Acer Negundo, L.—The Box Elder of North America. A tree deciduous, like the rest of the maples; attains a height of about fifty feet, and is rich in saccharine sap. Proved well adapted for our country.

Acer palmatum, Thunb.—This beautiful tree, with deeply cleft leaves, is indigenous to Japan, where various varieties with red and yellow tinged leaves occur. Should it be an aim to bring together all the kinds of maples, which could be easily grown in appropriate spots of Victoria, then Japan alone would furnish twenty-five species.

Acer platanoides, L.—The Norway Maple, extending south to Switzerland; seventy feet high. The pale wood much used by cabinet-makers.

Acer Pseudo-platanus, L.—The Sycamore Maple or British Plane. Attains a height of over one hundred feet. The wood is compact and firm, valuable for various implements, instruments, and cabinet work. It furnishes, like some other maples, a superior charcoal.

Acer rubrum, L.—The Red Maple, North America. A tree attaining eighty feet; fond of swampy places; wood close-grained. The trunk when twisted furnishes also curled-maple wood. Grows well with several other maples, even in dry open localities of this part of Australia, although the foliage may somewhat suffer from our hot winds.

Acer saccharinum, Wang.—One of the largest of the maples. In the colder latitudes of North Amer-

ica, eighty feet high. Wood of rosy tinge; when knotty or curly furnishes the birdseye and curly-maple wood. In the depth of Winter the trees, when tapped, will yield the saccharine fluid, which is so extensively converted into maple sugar, each tree yielding two to four pounds a year. The trees can be tapped for very many years in succession, without injury. The Sugar Maple is rich in potash. Numerous other maples exist, among which, as the tallest, may be mentioned *Acer Creticum*, L., of South Europe, forty feet; *A. lævigatum*, *A. sterculiaceum*, and *A. villosam*, Wallich, of Nepal, fifty feet; *A. pictum*, Thunb., of Japan, thirty feet.

Æsculus Hippocastanum, L.—Indigenous to Central Asia. One of the most showy of deciduous trees, more particularly when, during Spring, “it has reached the meridian of its glory, and stands forth in all the gorgeousness of leaves and blossoms.” Height, sixty feet. It will succeed in sandy soil on sheltered spots; the wood, adapted for furniture; the seeds, a food for various domestic animals; the bark, a good tanning material. Three species occur in Japan, and several, but none of great height, in North America and South Asia.

Ailanthus glandulosa, L.—S. E. Asia. A hardy, deciduous tree, sixty feet high, of rather rapid growth, and of very imposing aspect in any landscape. Particularly valuable on account of its leaves, which afford food to a silkworm (*Bombyx Cynthia*), peculiar to this tree; wood, pale yellow, of silky lustre when planed, and therefore valued for joiners’ work. In South Europe planted for avenues.

Alnus glutinosa, Gaertn. — The ordinary Alder.

Throughout Europe and extra-tropical Asia, seventy feet high ; well adapted for river banks ; wood, soft and light, turning red, furnishing one of the best charcoals for gunpowder ; it is also durable under water, and adapted for turners' and joiners' work. *A. incana*, Willd., is an equally high and allied species.

Amyris terebinthifolia, Tenore.—Brazil. Is here perfectly hardy, and is content in dry ground, without any irrigation. It proved one of the best among the smaller avenue trees, is beautifully spreading and umbrageous, and probably of medicinal value.

Angophora intermedia, Cand.—South East Australia. This is the best of the Angophoras, attaining a height of fifty feet, and growing with the rapidity of an Eucalyptus, but being more close and shady in its foliage. It would be one of our best trees to line public roads, and to effect shelter plantations.

⚔ *Baloghia lucida*, Endl. (*Codiaeum lucidum*, J. M.)—East Australia. A middle-sized tree. The sap from the vulnerated trunk forms, without any admixture, a beautiful, red, indelible pigment.

Betula alba, L.—The ordinary Birch of Europe and extra-tropical Asia. It attains a height of eighty feet, and would here thrive best in moist glens of the ranges, or in the higher regions of our mountains, where it would form up at the Alpine Zone excellent shelter plantations. The durable bark serves for roofing. Wood white, turning red. The oil of the bark is used in preparing the Russian leather.

Betula nigra, L.—The Black or River Birch of North America. One of the tallest of birches. If grown on the banks of a limpid stream ; it will bear intense heat. The wood is compact, of a light color.

Betula papyracea, Ait.—The Paper Birch of North America. A larger tree than *B. alba*, with a fine-grained wood, and a tough bark ; much used for portable canoes. It likes a cold situation.

Betula lenta, Willd.—The Cherry Birch of North America. A tree of middle size, liking moist ground. Bark, aromatic. Wood, rose-colored or dark, fine-grained, excellent for furniture. Several birches occur in Japan, which might well be tried here.

Carpinus Betulus, L.—The Hornbeam. A tree of eighty feet high. Middle and South Europe. Wood, pale, of a horny toughness and hardness, close-grained, but not elastic. This tree would serve to arrest the progress of bush-fires, if planted in copses or hedges, like willows and poplars, around forest plantations. A smaller species, *Carpinus Americana*, Mich., yields the iron-wood of South America ; four species occur in Japan : (*C. cordata*, *C. erosa*, *C. laxiflora*, *C. Japonica*, Blume). *Carpinus viminea* (Wallich), is a species with durable wood, from the middle regions of Nepal.

Carya alba, Nuttall.—The Shellbark Hickory. A deciduous tree, ninety feet high, which delights in rich forest soil ; a native of North America. Wood, strong, elastic, and tenacious, but not very durable. Yields the main supply of hickory nuts. All the hickories are extensively used in North America for hoops.

Carya amara, Nuttall. — The Bitternut - tree or Swamp Hickory. A tree, eighty feet high, in swampy grounds of North America. Wood less valuable than that of other hickories.

Carya glabra, Torrey. (*Carya porcina*, Nuttall.)—

The Hognut-tree. A tree, eighty feet high, in forest land of North America. Wood very tough; the heart-wood reddish or dark-colored; much used for axletrees and axehandles.

Carya oliviformis, Nuttall.—The Pecan Nut Tree. A lofty tree, fond of river-banks in North America.

Carya sulcata, Nuttall.—The furrowed Hickory and Shellbark Hickory of some districts; also, Shagbark Hickory. A tree, eighty feet high, in damp woods of North America. Heart-wood, pale-colored. Seed of sweet, pleasant taste.

Carya tomentosa, Nuttall.—The Mocker Nut Tree or White Heart Hickory. A big tree of North America. Likes forest soil, not moist. Heart-wood pale-colored, remarkable for strength and durability. Seeds very oily. Nut small, but sweet. A variety produces nuts as large as an apple.

Castanea sativa, Miller. (*C. vesca*, Gærtner.)—The Sweet Chestnut-tree. South Europe and temperate Asia, as far as Japan, and a variety with smaller fruits extending to North America. It attains an enormous age; at Mount Etna an individual tree occurs with a stem two hundred and four feet in circumference. The wood is light and coarse-grained; the importance of the tree rests on its adaptability for shade plantations, its nutritious nuts and timber value.

Castanopsis argentea, A. Condolle.—A lofty tree in the mountains of India, produces also edible chestnuts. Other species of the genus *Castanopsis* are valuable.

Casuarina glauca, Sieber.—The Desert She-oak, widely distributed through Australia, but nowhere in forest-like masses. This species attains, in favorable places, a height of eighty feet. Its hard durable

wood is valuable. Important for its rapid growth, resistance to exposure for shelter plantation, and a speedy supply of fuel, a remark which applies also to the following species :

Casuarina quadrivalvis, Labillard.—The Coast She-oak of South-east Australia, yet not merely living in coast sand, but also on barren places up to the hills inland. Height to sixty feet. The male tree is very eligible for avenues, the foliage of the species being drooping. Cattle are fond of the foliage. For arresting the ingress of coast-sand by belts of timber, this is one of the most important trees. It produces, like other *Casuarinas*, seeds early and copiously, and is easily raised.

Casuarina suberosa, Willd.—The erect She-oak of South-east Australia. Height to forty feet. A beautiful shady species, *Casuarina trichodon* (Miq.), *C. Fraseriana*, (Miq.), and *C. Huegeliana* (Miq.), are arboreous species of South-west Australia, all valuable for their wood.

Cedrela Taona, Roxburgh.—The Singapore Cedar. A mere variety of this is the Red Cedar of East Australia (*Cedrela Australis*, Cunn.). The light, beautiful wood, easily worked and susceptible of high polish, is much in request for furniture, for the manufacture of piano-fortes, for boat-building and a variety of other work. As this important tree is largely extirpated in the cedar bushes, it is highly desirable to form of it in our rich forest gullies independent plantations for future local supply. The Red Cedar is hardy at Melbourne, but in our open exposed gardens and poor soil of slow growth.

Celtis Australis, L.—The Lotus-tree of South Eu-

rope and North Africa. Of longevity, fifty feet high, available for avenues. Berries edible. Wood hard and dense, eligible particularly for turners' and carvers' work.

Ceitis Occidentalis, L. — The Huckberry-tree. A fine forest tree in Ohio, and other parts of North America. Height, eighty feet. The variety called *C. crassifolia* is the best. The sweet fruits edible. Wood elastic and fissile.

Ceratonia Siliqua, L. — The Carob-tree of the Mediterranean regions. It attains a height of thirty feet, and resists drought well. Wood pale red. The saccharine pods, Algaroba, or St. John's Bread, of value for domestic animals. The seeds germinate readily.

Cinnamomum Camphora, Nees. — The Camphor-tree of China and Japan, attaining a height of about forty feet. It endures the occasional frosts of Port Philip, though the foliage will suffer. The wood, like all other parts of the tree, is pervaded by camphor, hence resists the attack of insects.

Corylus Colurna, L. — The Constantinople Nut-tree, the tallest of hazels, attaining sixty feet in height, of rather quick growth. This, as well as the European Hazel (*Corylus Avellana*, L.) and the Japan Hazel (*C. heterophylla*, Fischer), might be grown for copses in our forest gullies.

Corynocarpus lævigata, Forst. — The Karaka of New Zealand, and the principal forest tree of the Chatham Islands, attaining the height of sixty feet. The wood is light, and used by the natives for canoes. The pulp of the fruit is edible. Cattle browse on the foliage. In rich, humid soil the tree can be adopted for avenues.

Diospyros Virginiana, L.—The North American Ebony or Persimmon. A tree sixty feet high. Wood very hard and blackish. The sweet variety yields a good table-fruit.

Engelhardtia spicata, Blume.—The spurious Walnut-tree of the mountains of Java and the Himalayas. It reaches a height of two hundred feet.

Eucalyptus amygdalina, Labill.—In our sheltered, springy, forest-glens attaining not rarely a height of over four hundred feet, there forming a smooth stem, and broad leaves, producing, also, seedlings of a foliage different to the ordinary state of *Eucalyptus amygdalina*, as occurs in more open country. This species or variety, which might be called *Eucalyptus regnans*, represents the loftiest tree in British territory, and ranks next to the *Sequoia Wellingtonia* in size anywhere on the globe. The wood is fissile, well adapted for shingles, rails, for house-building, for the keelson and planking of ships, and other purposes. Labillardiere's name applies ill to any of the forms of this species. Seedlings raised on rather barren ground, near Melbourne, have shown the same amazing rapidity of growth as those of *Eucalyptus globulus*; yet, like those of *Eucalyptus obliqua*, they are not so easily satisfied with any soil.

Eucalyptus citriodora, Hooker. — Queensland. It combines with the ordinary qualities of many Eucalypts, the advantage of yielding from its leaves a rather large supply of volatile oil of excellent lemon-like fragrance.

Eucalyptus diversicolor, F. v. Mueller.—The Karri of South-west Australia. A colossal tree, exceptionally reaching to the height of four hundred feet, with

a proportionate girth of the stem. The timber is excellent. Fair progress of growth is shown by the young trees, planted even in dry exposed localities in Melbourne. The shady foliage and dense growth of the tree promise to render it one of our best for avenues. In its native localities it occupies fertile, rather humid valleys.

Eucalyptus globulus, Labill. — Blue Gum - tree of Victoria and Tasmania. This tree is of extremely rapid growth, and attains a height of four hundred feet, furnishing a first-class wood ; ship-builders get keels of this timber one hundred and twenty feet long; beside this, they use it extensively for planking and many other parts of the ship, and it is considered to be generally superior to American Rock Elm. A test of strength has been made between some Blue-Gum, English Oak, and Indian Teak. The Blue-Gum carried fourteen pounds weight more than the Oak, and seventeen pounds four ounces more than Teak upon the square inch. Blue-Gum wood, beside for ship-building, is very extensively used by carpenters for all kinds of out-door work, also for fence-rails, railway-sleepers—lasting about nine years—for shafts and spokes of drays, and a variety of other purposes.

Eucalyptus gomphocephala, Candolle.—The Tooart of South-west Australia ; attains a height of fifty feet. The wood is close-grained, hard, and not rending. It is used for ship-building, wheelwright's work, and other purposes of artisans.

Eucalyptus marginata, Smith.—The Jarrah or Mahogany - tree of South - west Australia, famed for its indestructible wood, which is attacked neither by chelura, nor teredo, nor termites, and therefore so

much sought for jetties and other structures exposed to sea-water; also, for any underground work, and largely exported for railway-sleepers. Vessels built of this timber have been enabled to do away with all copper-plating. It is very strong, of a close grain, and a slightly oily and resinous nature; it works well, makes a fine finish, and is by ship-builders here considered superior to either oak, teak, or indeed, any other wood. The tree grows chiefly on iron-stone ranges. At Melbourne it is not quick of growth, if compared to our Blue Gum (*Eucalyptus globulus*, Lab.), or to our Stringy-bark (*E. obliqua*, l'Her.), but it is likely to grow with celerity in our ranges.

Eucalyptus rostrata, Schlechtendal.—The Red Gum of Victoria, South Australia, and many river-flats in the interior of the Australian continent. Although a native tree of this colony, it has been introduced into this list on account of its wood being of extraordinary endurance under ground, and for this reason so highly valued for fence-posts, piles, and railway-sleepers; for the latter purpose it will last at least a dozen years, and, if well selected, much longer. It is also extensively used by ship-builders, for main-stem, stern-post, inner-post, dead-wood, floor-timbers, futtocks, transomes, knight-head, hawse-pieces, cant, stern, quarter and fashion-timber, bottom-planks, breast-hooks and riders, windlass, bow-rails, etc. It should be steamed before it is worked for planking. Next to the Jarrah, from West Australia, this is the best wood for resisting the attacks of sea-worms and white ants. For other details of the uses of this and other native trees refer to the reports of the Victorian Exhibitions of 1862 and 1867. The tree attains a

height of fully one hundred feet. The supply for our local wants falls already short, and cannot be obtained from Tasmania, where the tree does not naturally exist.

Eucalyptus sideroxylon, Cunn.—Iron-bark tree. It attains a height of one hundred feet, and supplies a valuable timber, possessing great strength and hardness; it is much prized for its durability by carpenters, ship-builders, etc. It is largely employed by wagon-builders for wheels, poles, etc.; by ship-builders for top-sides, tree-nails, the rudder (stock), belaying-pins, and other purposes; it is also used by turners for rough work. This is considered the strongest wood in our colony. It is much recommended for railway-sleepers, and extensively used in underground mining work.

Excæcaria sebifera, J. M. (*Stillingia sebifera*, (Mich.).)—The tallow-tree of China and Japan. The fatty coating of the seeds yields the vegetable tallow. The wood is so hard and dense as to be used for printing blocks; the leaves furnish a black dye. The tree endures the night frosts of our open lowlands, though its foliage suffers.

Fagus Cunninghami, Hooker.—The Victorian and Tasmanian Beech. A magnificent evergreen tree, attaining colossal dimensions, and only living in cool, damp rich forest valleys, not rarely two hundred feet high. The wood much used by carpenters and other artisans, the myrtlewood of the trade. It requires to be ascertained by actual tests in the forests whether the allied tall evergreen New Zealand beeches possess any advantage over ours for forest culture; they are; *Fagus Menziesii*, Hooker, the Red Birch of the

colonists; *Fagus Fusca*, Hook., the Black Birch; *Fagus Solandri*, Hook., the White Birch. A magnificent beech, *Fagus Moorei*, F. von Muell. occurs in New England.

Fagus silvatica, L.—The deciduous Beech of Britain, of most other parts of Europe and extra-tropical Asia, and as *Fagus ferruginea*, Ait., in a particular variety, extending through North America. The trunk has been measured in height, one hundred and eighteen feet, the head, three hundred and fifty feet in diameter; the wood is hard, extensively used by joiners and ship-builders. An allied Beech, *Fagus Sieboldii*, Endl., occurs in Japan. All these could here be grown to advantage only in our springy mountain forests.

Ficus sycamorus, L.—The Sycamore Fig-tree of the Orient, copiously planted along the road-sides of Egypt. The shady crown extends to a width of one hundred and twenty feet. Though introduced, we have, as yet, no local means of raising this tree in quantity, and must therefore rely on fresh importations of cuttings, or more particularly seeds.

Ficus macrophylla, Desfont.—The Moreton Bay Fig-tree, which is indigenous through a great part of East Australia. Perhaps the grandest of our avenue trees, and among the very best to be planted, although in poor, dry soil its growth is slow. In our latitudes it is quite hardy in the lowland. The foliage may occasionally be injured by grasshoppers. Easily raised from seed.

Fraxinus Americana, L.—The White Ash of North America. A large tree, eighty feet high, which delights in humid forests. Timber valuable, better

resisting extreme heat than the common ash. The Red Ash (*Fraxinus pubescens*, Lam.), the Green Ash (*F. viridis*, Michx.), the Black Ash (*F. sambucifolia*, Lam.), and the Carolina Ash (*F. platycarpa*, Michx.), are of smaller size.

Fraxinus excelsior, L.—The ordinary Ash of Europe and West Asia. Height eighty feet, of comparatively quick growth, known to attain an age of nearly two hundred years. Rich soil on forest rivulets or river-banks suit it best; wood remarkably tough and elastic, used for agricultural and other implements, for oars, axletrees and many other purposes. Six peculiar kinds of ash-trees occur in Japan, some also in the Indian highlands; all might be tried here.

Fraxinus floribunda, Don.—Nepal Ash, forty feet high.

Fraxinus Ornus, L.—The Manna Ash of the Mediterranean regions. Height about thirty feet. It yields the medicinal manna.

Fraxinus quadrangulata, Michx.—The Blue Ash of North America. One of the tallest of the ashes, seventy feet high, with an excellent timber.

Fraxinus viridis, Mich.—The Green Ash of North America. Height seventy feet; wood excellent.

Gleditschia triacanthos, L.—The deciduous Honey Locust-tree of North America. Height up to eighty feet. Wood hard, coarse-grained, fissile. Sown closely, this plant forms impenetrable, thorny, not readily combustible hedges. An allied species, the *G. horrida*, Willd., in East Asia. The Water Locust-tree of North America (*Gleditschia monosperma*, Walt.), will grow in swamps to eighty feet.

Grevillea robusta, Cunningh.—Our beautiful Lawn-

tree, indigenous to the sub-tropical part of East Australia, one hundred feet high, of rather rapid growth, and resisting drought in a remarkable degree; hence one of the most eligible trees for desert-culture. Our cultivated trees yield now already an ample supply of seeds. The wood is valued particularly for staves of casks.

Guevina Avellana, Molina (*Quadria heterophylla*, R. & P.).—The evergreen Hazel-tree of Chile, growing as far as thirty degrees south. It attains a height of thirty feet, and yields the hazel-nuts of South America.

Gymnocladus Canadensis, Lamark.—The Chirot. A North American timber and avenue tree, attaining a height of eighty feet; allied to *Gleditschia*, but, as the name implies, thornless. The wood is strong, tough, compact, fine-grained, and assumes a rosy color.

Juglans cinerea, L.—The Butternut-tree of North America. About fifty feet high; stem-diameter four feet. Likes rocky places in rich forests. Wood lighter than that of the Black Walnut, durable, and free from attacks of insects.

Juglans nigra, L.—Black Walnut-tree. Attains a height of seventy feet; trunk four feet in diameter; found in rich forest land in North America. Wood purplish brown, turning dark with age, strong, tough, not liable to warp or to split; not attacked by insects. Seed more oily than the European walnut.

Juglans regia, L.—The ordinary Walnut-tree of Europe, but of Central Asiatic origin; it attains a height of fully eighty feet, and lives many centuries. Wood light and tough, much sought for gun-stocks,

furniture and other things. The shells of the nut yield black pigment. Trees of choice quality of wood have been sold for six hundred pounds, the wood being the most valuable of Middle Europe. Can be grown in cold localities, as it lives at two thousand feet elevation in Middle Europe. The Californian Walnut-tree (*Juglans rupestris*, Engelmann) and the Chinese Walnut-tree (*Juglans Mandchurica*, Maxim.) ought to be introduced here.

Leucadendron argenteum, Brown. — The Silver-tree of South Africa is included, on this occasion, among forest trees, because it would add to the splendor of our woods, and thrive far better there than in our gardens. Moreover, with this tree many others, equally glorious, might be established in our mild forest glens, as a source of horticultural wealth, were it only to obtain, in future years, a copious supply of seeds. Mention may be made of the tall Magnolia-trees of North America (*Magnolia grandiflora*, L., one hundred feet high; *M. umbrella*, Lam., forty feet; *M. acuminata*, L., eighty feet; *M. cordata*, Michx., fifty feet; *M. Fraseri*, Walt., forty feet; *M. macrophylla*, Michx., forty feet), *M. Yulan*, Desf., of China, fifty feet; *Magnolia Campbelli*, Hook., of the Himalayas, one hundred and fifty feet high, and flowers nearly a foot across; *M. sphaerocarpa*, Roxb., also of the Indian Highlands, forty feet; the North American Tulip-tree (*Liriodendron tulipifera*, L.), one hundred and forty feet high, stem nine feet in diameter; Mediterranean Styrax-tree (*Styrax officinalis*, L.); *Stenocarpus sinuosus*, Endl., of East Australia (the most brilliant of the Proteaceæ); the crimson and scarlet Ratas of New Zealand (*Metrosideros*

florida, Sm.; *M. lucida*, Menz.; *M. robusta*, Cunn., eighty feet high; *M. tomentosa*, Cunn., forty feet); *Fuchsia excorticata*, L., also from New Zealand, stem two feet in diameter; the crimson-flowered *Eucalyptus ficifolia* of West Australia; *Rhododendron Falconeri*, Hooker, from Upper India, fifty feet high, leaves, eighteen inches long. In the sassafras gullies, here alluded to, also may be planted the great *Melaleuca Leucadendron*, L., the true Asiatic Cajuput-tree, which grows to a height of one hundred feet; even the North European Holly (*Rex Aquifolium*), which occasionally rises to sixty feet, though both from regions so distant.

Liquidambar Altingia, Blume.—At the Red Sea and in the mountains of India and New Guinea, at three thousand feet, and probably hardy in the warmer parts of our colony. The tree attains a height of two hundred feet. It yields the fragrant balsam known as liquid storax.

Liquidambar styraciflua, L.—The Sweet Gum-tree. In morasses and on the springs of the forests of North America, with a wide geographic range. The tree attains vast dimensions of its crown; the stem ten feet in diameter. The terebinthine juice hardens, on exposure, to a resin of benzoin odor. Wood, fine-grained.

Macadamia ternifolia, F. von Muell. (*Helicia ternifolia*, F. M.)—The Nut-tree of sub-tropic East Australia, attaining a height of sixty feet; hardy, as far south as Melbourne; in our forest valleys likely of fair celerity of growth. The nuts have the taste of hazels.

Morus rubra, L.—The Red Mulberry-tree of North

America. Is the largest of the genus, attaining a height of seventy feet; it produces a strong and compact timber. The White Mulberry-tree (*Morus alba*, L.), with others, offering food to the silkworms, should be planted copiously everywhere for hedges or copses.

Maclura aurantiaca, Nuttall.—The Osage Orange of North America. Greatest height sixty feet; wood bright yellow, very elastic, fine-grained. For deciduous thorn-hedges the plant is important; its value for silkworms needs further to be tested.

Ostrya carpinifolia, Scopoli. — South Europe and Orient. The Hop Hornbeam. A deciduous tree, sixty feet high.

Ostrya Virginica, Willdenow.—Leverwood-tree of North America, forty feet high, in rich woodlands. Wood singularly hard, close-grained and heavy, in use for levers and other implements.

Pistacia vera, L.—Indigenous in the Orient, as far as Persia. A deciduous tree, thirty feet high, yielding the Pistachio nuts of commerce, remarkable for their green, almond-like kernels. The likewise deciduous Mediterranean *Pistacia Terebinthus*, L., yielding the Chio Turpentine, the *P. Atlantica*, Desf., and the evergreen South European *Pistacia Lentiscus*, L., furnishing the mastix, grow rarely to the size of large trees.

Planera Japonica, Miquel.—Considered one of the best timber-trees of Japan.

Platanus occidentalis, L.—The true Plane-tree of the east part of North America. More eligible as an avenue tree than as a timber-tree; diameter of stem at times fourteen feet; wood dull red,

Platanus orientalis, L.—The Plane-tree of South

Europe and Middle Asia. One of the grandest trees for lining roads and for street planting, deciduous like the other planes, rather quick of growth, and not requiring much water; attains a height of ninety feet. The wood is well adapted for furniture and other kinds of cabinet work.

Platanus racemosa, Nuttall.—The California Plane-tree. Wood harder and thus more durable than that of *P. occidentalis*, also less liable to warp.

Populus alba, L.—The Abele or White Poplar of Europe and Middle Asia. Height ninety feet. It proved here an excellent avenue tree, even in comparatively waterless situations, and gives, by the partial whiteness of its foliage, a pleasing effect in any plantation. *Populus canescens*, Sm., the gray Poplar, is either a variety of the Abele or its hybrid with the Aspen, and yields a better timber for carpenters and millwrights.

Populus balsamifera, L.—The Hackmatack (Tamarack) or Balsam Poplar, of the colder, but not the coldest parts of North America, eighty feet high. Its variety is *P. candicans*, Aiton.

Populus grandidentata, Michaux.—North America, sixty feet high. A kind of aspen.

Populus heterophylla, L. — The downy Poplar of North America. Height sixty feet.

Populus monilifera, Aiton. (*P. Canadensis*, Desf.) —The Cottonwood-tree of North America. Height one hundred feet. One of the best poplars for the production of timber.

Populus nigra, L. — The European Black Poplar, extending spontaneously to China. It includes *Populus dilatata*, Aiton, or as a contracted variety, *P. fasti-*

giata, Desf., the Lombardy Poplar. Greatest height one hundred and fifty feet. Growth rapid, like that of all other poplars. Wood soft, light, and of loose texture, used by joiners, coopers, and turners, furnishing, also, superior charcoal. Bark employed in tanning. The tree requires damp soil.

Populus tremula, L.—The European Aspen. Height eighty feet. It extends to Japan, where also a peculiar species, *Populus Sieboldii* (Miq.), exists. The aspen-wood is white and tender, and in use by coopers and joiners.

Populus tremuloides, Michaux.—The North American Aspen. Height fifty feet. It extends west to California, where a particular species, *Pop. trichocarpa*, Torrey, occurs. All poplars might be planted, like all willows, in our gullies, to intercept forest-fires; also, generally on river-banks.

Quercus Ægilops, L.—South Europe. A tree of the size of the British Oak. The cups, known as Valonia, used for tanning and dyeing; the unripe acorns as Camata or Camatena, for the same purpose. The wood is capital for furniture.

Quercus alba, L.—The White or Quebec Oak. A most valuable timber tree, one hundred feet high; diameter of stem, seven feet. Wood in use by ship-builders, wheelwrights, coopers, and other artisans.

Quercus annulata, Smith.—A large Oak of Nepal, which provides a very good timber.

Quercus aquatica, Walter.—North America. Height of tree sixty feet; it furnishes a superior bark for tanning, also wood for ship-building.

Quercus Cerris, L.—South Europe; of the height of the English Oak; in suitable localities of quick growth.

The foliage deciduous, or also evergreen. The wood available for wheelwrights, cabinet-makers, turners, coopers; also for building purposes.

Quercus coccifera, L.—The deciduous Kermes Oak of South Europe; so called from the red dye, furnished by the *Coccus ilicis*, from this oak. It also supplies tanner's bark. The huge and ancient Abraham's Oak belongs to this species.

Quercus coccinea, Wangenheim.—The Black Oak of North America. Height, one hundred feet; stem-diameter, five feet. Foliage deciduous. The yellow dye, known as Quercitron, comes from this tree. Bark rich in tannic acid.

Quercus cornea, Loureiro.—China. An evergreen tree, forty feet high. Acorns used for food.

Quercus falcata, Michaux.—North America. Foliage deciduous. Lives in dry, sandy ground. A good-sized tree, with excellent tanner's bark.

Quercus Ilex, L.—The Holly Oak of South Europe. Height of tree fifty feet. Wood in use for ship-building, bark for tanning. From varieties of this tree are obtained the sweet and nourishing ballota and chestnut acorns.

Quercus incana, Roxb.—A Himalayan timber-tree of great dimensions; beautiful, evergreen.

Quercus infectoria, Oliv.—Only a small tree, with deciduous foliage. Chiefly from this tree the galls of commerce are obtained.

Quercus lancifolia, Roxb.—A tall timber-tree of the Himalayas. Wood valued for its durability.

Quercus macrocarpa, Michx.—The Burr Oak of North America. Tree seventy feet high. The timber nearly as good as that of the White Oak.

Quercus palustris, Du Roi.—The Marsh Oak of North America. Height eighty feet; of quick growth. The wood, though not fine-grained, is strong and tough.

Quercus Prinus, L.—The North American Swamp Oak. A tree ninety feet high, available for wet localities. Foliage deciduous. Wood strong and elastic, of fine grain. A red dye is produced from the bark.

Quercus Robur, L.—The British Oak, extending through a great part of Europe and Western Asia, attaining a great age and an enormous size. Extreme height one hundred and twenty feet. Two varieties are distinguished: 1. *Quercus sessiliflora*, Salisbury. The Durmast Oak, with a darker, heavier timber, more elastic, less fissile. This tree is also the quickest of the two in growth, and lives on poorer soil. Its bark is also richer in medicinal, dyeing and tanning principles. 2. *Quercus pedunculata*, Willd. This variety supplies most of the oak-timber in Britain for ship-building, and is the best for bending under steam. It is also preferred for joiner's work.

Quercus rubra, L.—The Red Oak of North America. Height one hundred feet; diameter of stem four feet. The wood is not of value; but the bark is rich in tannin. Autumnal tint of foliage beautifully red.

Quercus semecarpifolia, Smith.—In the Himalayas. Height of tree often one hundred feet; girth of stem eighteen feet. It furnishes a first-class timber.

Quercus serrata, Thunberg.—One of the twenty-three known Japan oaks. It yields the best food for the oak silk-worm (*Bombyx Yamamai*).

Quercus Sideroxylon, Humboldt. — Mountains of

Mexico, at eight thousand feet elevation. An oak of great size, of compact timber, almost imperishable in water. *Q. lanceolata*, *Q. chrysophylla*, *Q. reticulata*, *Q. laurina*, *Q. obtusata*, *Q. glaucescens*, *Q. Xalapensis* (Humb.) and *Q. acutifolia* (Nee), are among the many other highly important timber oaks of the cooler regions of Mexico.

Quercus squamata, Roxburgh.—One of the tallest of the Himalayan Oaks. Wood lasting.

Quercus Suber, L.—The Cork Oak of South Europe and North Africa; evergreen. It attains an age of fully two hundred years. After about twenty years it can be stripped of its bark every six or seven years; but the best cork is obtained from trees over forty years old. Height of tree about forty feet. Acorns of a sweetish taste.

Quercus Sundaica, Blume.—One of the oaks from the mountains of Java, where several other valuable timber oaks exist.

Quercus Toza, Bosc.—South Europe. One of the handsomest oaks, and one of the quickest of growth. Foliage evergreen.

Quercus virens, L.—The Live Oak of North America, evergreen, fifty feet high. Supplies a most valuable timber for shipbuilding; it is heavy, compact, fine-grained; it is moreover the strongest and most durable of all American oaks. Like *Q. obtusiloba*, Michaux., it lives also on seashores, helping to bind the sand, but it is then not of tall stature. Of many of the three hundred oaks of both the western and eastern portions of the northern hemisphere, the properties remained unrecorded, and perhaps unexamined; but it would be important to introduce as

many kinds as possible for local test-growth. The acorns, when packed in dry moss, retain their vitality for some months. The species with deciduous foliage are not desirable for massive ornamental planting, because in this clime they shed their dead leaves tardily during the very time of their greatest verdure.

Rhus vernicifera, Cand.—Extends from Nepal to Japan. It forms a tree of fair size, and yields the Japan varnish.

Rhus succedanea, L.—The Japan Wax-tree, the produce of which has found its way into the English market. The Sumac (*Rhus coriaria*, L.), and the Scotino (*Rhus Cotinus*, L.), both important for superior tanning and for dyeing, thrive here quite as well as in South Europe. They are more of shrubby growth.

Robinia pseudacacia, L.—The North American Locust Acacia. Height to ninety feet. The strong, hard and durable wood is for a variety of purposes in use, and particularly eligible for tree-nails. The roots are poisonous. The allied *Robinia viscosa* attains a height of forty feet.

Sassafras officinale, Hayne.—The deciduous Sassafras-tree, indigenous from Canada to Florida, in dry, open woods. Height fifty feet; leaves lobed; wood and bark medicinal, and used for the distillation of sassafras oil.

Sophora Japonica, L.—A tree of China and Japan, resembling the Laburnum, up to sixty feet high; wood hard and compact, valued for turner's work. All parts of the plant purgative; the flowers rich in a yellow dye.

Salix alba, L.—The Huntingdon or Silky Willow of Europe and Middle Asia. Height eighty feet, circumference of stem twenty feet; wood light and elastic, available for carpenter's work and implements, bark for tanning. The golden Osier (*Salix vitellina*, L.) is a variety. The shoots are used for hoops and wickerwork.

~~Salix~~ *Salix Babylonica*, Tournefort.—The Weeping Willow, indigenous from West Asia as far as Japan. Important for consolidating river-banks.

Salix caprea, L.—The British Sallow, or Hedge Willow; grows also to a tree; wood useful for handles and other implements; bark for tanning. It is the earliest flowering willow.

Salix cordata, Muehlenb. —One of the Osiers of North America.

Salix daphnoides, Villars. —Middle Europe and Northern Asia, as far the Amoor. A tree of remarkable rapidity of growth—twelve feet in four years.

Salix fragilis, L. —The Crack Willow. Height, ninety feet, stem to twenty feet in girth. A variety of this species is the Bedford Willow, *Salix Russelliana*, Smith, which yields a light, elastic, tough timber, more tannin in its bark than oak, and more salicine (a substitute for quinine) than most congeners.

Salix lanceolata, Smith.—One of the Basket Willows, cultivated in Britain.

Salix lucida, Muehlenb.—One of the Osiers of North America.

Salix purpurea, L.—Of wide range in Europe and West Asia. One of the Osiers.

Salix rubra, Hudson.—Throughout Europe; also West Asia and North Africa; is much chosen for

osier beds. When cut down, it will make shoots eight feet long in a season.

Salix triandra, L. (*S. amygdalina*, L.)—The Almond Willow, through nearly all Europe and extra-tropical Asia. Height of tree, thirty feet. Shoots, nine feet long; for hoops and white basket-work, being pliant and durable.

Salix viminalis, L.—The common Osier of Europe and North Asia; attains the height of thirty feet. One of the best for wicker-work and hoops; when cut, it shoots up to a length of twelve feet. It would lead too far to enumerate even the most important willows on this occasion. Professor Andersson, of Stockholm, admits one hundred and fifty-eight species. Besides these, numerous hybrids exist. Many of the taller of these willows could here be grown to advantage.

Tilia Americana, L.—The Basswood-tree, or North American Linden-tree, growing to fifty-two degrees north latitude. Height of tree, eighty feet, diameter of stem four feet; wood pale and soft. *Tilia heterophylla*, Vent., the Silver Lime of North America, and *Tilia manchurica*, Rupr., of South Siberia, might be tested.

Tilia Europæa, L.—The common Lime of Europe, extending naturally to Japan, the large-leaved variety of South European origin. Height, up to one hundred and twenty feet; exceptionally fifty feet in girth. The wood pale, soft, and close-grained; sought for turnery and carving; the bast excellent for mats.

Ulmus alata, Michx.—The Whahoo Elm of North America. Height of tree, thirty feet; wood fine-grained.

Ulmus Americana, L.—The White Elm of North America; a tree fond of moist river-banks; one hundred feet high; trunk sixty feet; five feet in diameter.

Ulmus campestris, L.—The ordinary Elm, indigenous to South Europe and temperate Asia, as far East as Japan. Several marked varieties, such as the Cork Elm and Wych Elm, exist. The Elm in attaining an age of several centuries becomes finally of enormous size. The wood is tough, hard, fine-grained, and remarkably durable, if constantly under water; next to the Yew, it is the best of European woods, where great elasticity is required, as for archery bows. It is also used for keels, blocks, and wheels. Bast tough.

Ulmus Floridana, Chapman. —The West Florida Elm; forty feet high.

Ulmus fulva, Michx.—The Slippery or Red Elm of North America, sixty feet high; wood red, tenacious.

Ulmus racemosa, Thomas.—The Cork Elm of North America.

For fuller information on trees, long known, refer to Loudon's classic "Arboretum;" also, for many further details, to Lindley's Treasury of Botany, to Asa Gray's Manual, to Nuttall's North American Sylva, to Lawson's Pinetum, and many local works; also to the volumes of the Exhibitions of 1862 and 1867.

SELECT PLANTS

(EXCLUSIVE OF TIMBER TREES)

READILY ELIGIBLE FOR

VICTORIAN INDUSTRIAL CULTURE,

With indications of their native countries and some of their uses.

AN ENUMERATION OFFERED BY

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When offering an Appendix to the Acclimatization Society's Report of last year, in the enumeration of timber-trees desirable for a country of our clime, my willingness was expressed to extend the notes then offered also to other plants of prominent utilitarian value. So considerate was the reception which the former Appendix experienced that I am induced already to redeem my promise of extending these data; and I do this with all the more readiness, as the rapid progress of tillage almost throughout our colonial dominion is causing more and more a desire for the general and particular indication of such plants

which a colder clime excludes from the northern countries, where most of us spent our youth. Within the pages allotted to this communication the notes offered could only be indicative. Hence this list is merely intended to facilitate the choice of selection. More extensive information must be sought in special works, to which, through the English language, access is given by the literature of Britain and North America. Thus the colonist, who wishes to pursue an altered path of husbandry, by adopting some new foreign plants for his culture, can follow up easily enough the inquiry to which he may be led by the indications now submitted.

The writer found himself surrounded by some difficulty of drawing the line of demarcation between the plants admissible into this list and those which should be excluded, because the final importance of any particular species, for a particular want, locality, or treatment, cannot be fully foretold. Moreover, the field is so ample from which our plants for novel culture may be gathered that only the first installment of a suggestive and abridged index could be presented on this occasion ; but it may be supplemented, as well as the former notes on timber-trees, should friendly consideration recognize the spirit in which these suggestions are offered. As an instance of the difficulty to educe what is most desirable for an enumeration such as the present it may be mentioned that many species of the thousands of foreign grasses would be highly eligible here, either for naturalization or for cultural purposes. A few, however, could only be singled out for the present purpose, and this with no other view than leading the occupants of our

soil onward in some new direction for their pastoral or agrarian pursuits.

The plants which appear to be of primary importance for our rural wants have been designated in this list with an asterisk. Of these, indeed, many are long since secured by the efforts of numerous colonists and their friends abroad, who strove to enrich our cultural resources; and in these efforts the writer, so far as his public or private means did permit, has ever endeavored to share. But although such plants are introduced, they are not in all instances as yet widely diffused, nor in many localities tested. Also, for the sake of completeness, ordinary culture plants appear in this index, as the opportunity seemed an apt one to offer a few passing remarks on their value. The claims of this contribution to originality must necessarily be very limited. What for ages has engaged the reflection of thousands cannot present absolutely or largely a new field of research. So it is especially with the means and objects of ordinary culture of fields. To gather, therefore, from a widely scattered literature that which might be here instructive or suggestive was mainly my task, though those gatherings may prove insignificant. Likely also such enumerations, in a very condensed form, will promote our communications for rural interchanges, both cis and trans-equatorial, though mainly with the countries of the Northern Hemisphere, which predominantly, if not almost exclusively, provided all the vegetable substances which enter into the main requisites of our daily life. Lists like the present may aid also in naming the plants and their products with scientific correctness in establishments

of economic horticulture, or in technologic or other educational collections. In grouping, at the close of this tract, the genera of the plants enumerated, according to the product which they yield, facility is afforded for tracing out any particular series of plants about which special economic information may be sought, or which may prominently engage at any time the attention of the cultivator, the manufacturer, or the artisan.

Acacia Farnesiana, Willd. — Dioscorides's small *Acacia*. Indigenous to South Asia; found westward as far as Japan; a native also of the warmer parts of Australia, as far south as the Darling River; found spontaneously in tropical and sub-tropical America, but apparently not in tropical Africa. Professor Fraas has recognized in this *acacia* the ancient plant. The scented flowers are much sought after for perfumery. This bush may also be utilized as a hedge plant, and a kind of Gum Arabic may be obtained from it.

Achillea Millefolium, L.—Yarrow or Millfoil. Europe, Northern Asia, and North America. A perennial medicinal herb of considerable astringency, pervaded with essential oil, containing also a bitter principle (*Achillein*) and a peculiar acid, which takes its name from the generic appellation of the plant.

Aconitum Napellus, L. — The Monk's Hood. In the colder, especially mountainous parts of Europe and Northern Asia. A powerful medicinal plant of perennial growth, but sometimes only of biennial duration, variable in its forms. It was first introduced into Australia, together with a number of other aconits, by the writer of this communication. All the species possess more or less modified medicinal qualities, as

well in their herb as in their root ; but so dangerously powerful are they that the plants can only be administered by the exercise of legitimate medical practice. Napellus root, according to Professor Wittstein, contains three alkaloids : Aconitin, Napellin, and Narcotin. The foliage contains also a highly acrid, volatile principle, perhaps chemically not unlike that of many other Ranunculaceæ. Aconitin, one of the most potent of any of the medicinal substances in existence, can likewise be obtained from the Nepalese *Aconitum ferox*, and probably from several other species of the genus.

Acorus Calamus, L. — The Sweet Flag. Europe, Middle and North Asia, North America. A perennial pond or lake plant. The somewhat aromatic root is used as a stomachic, and also in the preparation of confectionery, in the distillation of gin, and in the brewing of some kinds of beer. The flavor of the root depends mainly on a peculiar volatile oil.

Actæa, spicata, L. — The Baneberry. On forest mountains, mainly in limestone soil of Europe, North Asia, and North America. A perennial medicinal herb. Its virtue depends on peculiar acrid and bitter, as well as tonic principles. In North America, this species, and likewise *A. alba*, are also praised as efficacious antidotes against ophidian poisons.

Adesmia balsamica, Bertero.—The Jarilla of Chile. A small shrub, remarkable for exuding a fragrant balsam of some technic value.

Æschynomene aspera, L.—The Solah of tropical Asia. A large, perennial, erect, or floating swamp plant, probably hardy in the warmer tracts of our colony. Introduced from the Botanic Garden of Mel-

bourne into the tropical parts of Australia. The pith-hats are made from the young stems of this plant. The Solah is of less importance for cultivation than for naturalization.

Agave Americana, L.—The gigantic Aloe of Central America. It comes here into flower in about ten years. The pithy stem can be utilized for some of the purposes for which cork is usually employed, for instance, to form the bottom of insect-cases. The honey-sucking birds and the bees are very fond of the flowers of this prodigious plant. The leaves of this and some other agaves, such as *A. Mexicana*, furnish the strong Pita-fibre, which is adapted for ropes, and even for beautiful textile fabrics. The sap can be converted into alcohol. Where space and circumstances admit of it, impenetrable hedges may be raised, in the course of some years, from agaves.

Agrostis alba, L.—The Fiorin or White Bent-grass. Europe, North and Middle Asia, North Africa, North America. Perennial, showing a predilection for moisture. It is valuable as an admixture to many other grasses, as it becomes available at the season when some of them fail. Sinclair regards it as a pasture grass, inferior to *Festuca pratensis*, and *Dactylis glomerata*, but superior to *Alopecurus pratensis*. The variety with long suckers is best adapted for sandy pastures, and helps to bind shifting sand on the sea-coast, or broken soil on river-banks.

Aletris farinosa, L.—The Colic root of the woodlands of North America. This pretty herb is of extreme bitterness, and can be medicinally administered as a tonic.

Alkanna tinctoria, Tausch.—On sandy places around

the Mediterranean Sea. It yields the Alkanna root, used for dyeing oleaginous and other substances. It might be naturalized.

Allium Schœnoprasum, L.—The Chives. Europe, Northern Asia, and North America. Available for salads and condiments. This species of allium seems not yet so generally adopted in our culinary cultivation as *Allium Ascalonicum* (the eschalot), *A. Cœpa* (the ordinary onion), *A. fistulosum* (the Welsh onion), *A. Porrum* (the leek), or *A. sativum* (the garlic). *A. Scorodoprasum*, or the Sand Leek of Europe and North Africa, resembles both garlic and eschalot.

Aloe ferox, Mill. —South Africa. This species yields the best Cape Aloe, as observed by Dr. Pappe. The simply inspissated juice of the leaves of the various species of this genus constitutes the aloe drug. It is best obtained by using neither heat nor pressure for extracting the sap. By re-dissolving the aqueous part in cold water, and reducing the liquid, through boiling, to dryness, the extract of aloes is prepared. All species are highly valuable in our colony, where they are hardy, and can be used, irrespective of their medicinal importance, to beautify any rocky or otherwise arid spot.

Aloe linguiformis, Miller—South Africa. According to Thunberg, from this species the purest gum-resin is obtained.

Aloe plicatilis, Mill.—South Africa. The drug of this species acts milder than that of *A. ferox*.

Aloe purpurascens, Haworth. —S. Africa. Again one of the plants which furnishes the Cape Aloe of commerce.

Aloe socotrina, L.—Hills of the Island of Socotra,

Also cultivated in Barbadoes and elsewhere, thus yielding the Socotrin Aloe.

Aloe spicata, Thunberg.—South Africa. This aloe provides Cape aloe. It is an exceedingly handsome plant.

Aloe vulgaris, Lamarck. —The yellow-flowered aloe. Countries around the Mediterranean Sea, also Canary Islands, on the sandy or rocky sea-coast. Dr. Sibthorp identified this species with the aloe of Dioscorides; hence it is not probable that *A. vulgaris* is simultaneously also of American origin, although it is cultivated in the Antilles, and furnishes from thence the main supply of the Barbadoes aloe. In East India this species is also seemingly only existing in a cultivated state. Haworth found the leaves of this and of *A. striata* softer and more succulent than those of any other aloe. It is said to be the only species with yellow flowers among those early known. It is also this species only which Professor Wilkomm and Professor Parlato record as truly wild in Spain and Italy.

Aloe Zeyheri, Harvey.—South Africa. A magnificent, very tall species, doubtless valuable like the rest.

Alopecurus pratensis, L.—Meadow Foxtail Grass. Europe, North Africa, North and Middle Asia. One of the best of perennial pasture grasses. Though so extensively cultivated for years in our colony, it is mentioned, for completeness' sake, in this list. It attains to its full perfection only after a few years of growth, as noticed by Sinclair. For this reason, it is not equal to *Dactylis glomerata*, for the purpose of changing crops. Otherwise it is more nutritious than the latter, although the annual return in Britain prov-

ed less. Sheep thrive well on it. Sinclair and others found that this grass, when exclusively combined with white clover, will support, from the second season, five ewes and five lambs on an acre of sandy loam. But this grass, to thrive well, needs land not altogether dry. In all permanent, artificial pastures this *Alopecurus* should form one of the principal ingredients, because it is so lasting and nutritive. In our alpine regions it would also prove prolific, and might convert many places there gradually into summer-runs. It is early flowering, and likes the presence of lime in the soil.

Alstonia constricta, F. v. M. — Warmer parts of East Australia, particularly in the dry, inland districts. The bark of this small tree is aromatic-bitter, and regarded as valuable in ague, also as a general tonic.

Alstroëmeria pallida, Graham. — Chile. Palatable starch can be obtained from the root of this plant, which, for its loveliness alone, deserves a place in any garden. The tubers of others of the numerous *Alstroëmerias* can doubtless be utilized in a similar technic manner.

Althæa officinalis, L. — The Real Marsh-Mallow. Europe, North Africa, North and Middle Asia. A tall, perennial herb, with handsome flowers. The mucilaginous root, and also the foliage, are used for medicinal purposes. The plant succeeds best on damp, somewhat saline, soil.

Amelanchier Botryapium, Candolle. — The Grape-Pear of North America. This fruit-tree attains a height of thirty feet. The purplish fruits are small, but of pleasant taste, and ripen early in the season.

This bush or tree will live in sandsoil ; but it is one of those hardy kinds particularly eligible for our alps.

Amygdalus communis, L. — The Almond-tree. Countries around the Mediterranean Sea and Orient. Both the sweet and bitter almond are derived from this species. Their uses, and the value of the highly palatable oil, obtained by pressure from them, are well known. This oil can well be chosen as a means of providing a pleasant substitute for milk, during sea voyages, etc., by mixing, when required, with it half its weight of powdered gum arabic, and adding then, successively, while quickly agitating in a stone mortar, about double the quantity of water. Thus a palatable and wholesome sort of cream, for tea or coffee, is obtained at any moment. There exist hard and soft shelled varieties of both the sweet and bitter almond. In time, they should form an important article of our exports. Almonds can even be grown on sea-shores. The crystalline Amygdalin can best be prepared from bitter almonds, through removing the oil by pressure, then subjecting them to distillation with alcohol, and finally precipitating with æther. The volatile bitter almond oil—a very dangerous substance—is obtained by aqueous distillation. Dissolved in alcohol, it forms the essence of almonds. This can also be prepared from peach-kernels.

Anacyclus Pyrethrum, Candolle.—Countries near the Mediterranean Sea. The root is used medicinally.

Andropogon avenaceus, Michaux. (*Sorghum avenaceum*, Chapman.)—North and Central America. This tall perennial grass lives in dry, sandy soil, and should here be tried for growth of fodder.

Andropogon bicolor, Roxburgh.—Warmer parts of

Asia. One of the annual tall Sorghums. It ripens its seeds in three or four months from the time of sowing, the produce in good soil being often upward of one hundredfold. It is a wholesome grain.

Andropogon Calamus, Royle.—Central India. The Sweet Calamus of the ancients. From this species the Gingergrass-oil of Nemaur is distilled, an article much used in perfumery.

Andropogon cernuus, Roxb. (*Sorghum cernuum*, Willd.)—One of the Guinea corns. India, where it is much cultivated, and so also in other tropical countries. It is perennial, and forms the “staff of life of the mountaineers” beyond Bengal. It reaches a height of 15 feet, with leaves over 3 feet long. The thick stems are rooting at the lower joints, and cattle are very fond of them. The grain white. The specific limits of the various sorghums are not well ascertained.

Andropogon citratus, Candolle.—The Lemon Grass of India. It yields an essential oil for perfumery; besides it is occasionally used for tea. This applies as well to *Andropogon Nardus*, L., and some allied grasses.

Andropogon Halepensis, Sibthorp.—South Europe, Orient. A rich perennial grass, cultivated often under the name of Cuba Grass.

Andropogon Ivarancusa, Roxb.—One of the fragrant grasses of North India, much used, like *A. Shœnanthus*.

Andropogon Martini, Roxb. (*A. flexuosus*, Nees.)—On the mountains of India. The fragrant citronella oil is distilled in Ceylon and elsewhere from the leaves of this species. General Martin observed that

cattle are voraciously fond of this grass ; but it imparts its fragrance to meat and milk.

Andropogon muricatus, Retz.—India. A swamp-grass, with delightfully fragrant roots.

Andropogon nutans, L. (*Sorghum nutans*, Gray.)—North America. A tall nutritious, perennial grass, content with dry and barren soil.

Andropogon saccharatus, Roxb. (*Sorghum saccharatum*, Pers.)—Tropical Asia. The Broom-corn. A tall annual species, splendid as a fodder grass. From the saccharine juice sugar is obtainable. A sample of such, prepared from plants of the Melbourne Botanic Garden, was shown at the Exposition of 1862. Thus sorghum furnishes also material for a well-known kind of brooms. A variety or a closely allied species yields the Caffir Corn (*A. Caffrorum*, Kunth.). The plant can be advantageously utilized for preparing treacle. For this purpose the sap is expressed at the time of flowering, and simply evaporated ; the yield is about 100 gallons from the acre. In 1860, nearly seven millions of gallons of sorghum treacle were produced in the United States.

Andropogon Shœnanthus, L.—Deserts of Arabia. A scented grass, allied to the Indian oil-yielding *Andropogons*. A similar species occurs in arid places of the interior of North Australia.

Andropogon Sorghum, Brotero. (*Sorghum vulgare*, Persoon.)—The large Indian Millet or Guinea Corn, or the Durra. Warmer parts of Asia. A tall annual plant. The grains can be converted into bread, porridge, and other preparations of food. It is a very prolific corn, and to us particularly valuable for green fodder. Many others of the numerous species of *Andropogon*

dropogon, from both hemispheres, deserve our attention.

Anemone pulsatilla, L. — Europe and Northern Asia. On limestone soil. This pretty perennial herb is of some medicinal importance.

Anona cherimolia, Miller. — Tropical and sub-tropical South America. This shrub or tree might be tried in the frostless lower valleys of East Gipps Land, where humidity and rich soil will also prove favorable to its growth. It yields the Cherimoyer fruit. The flowers are very fragrant.

Anthemis nobilis, L. — The true Camomile. Middle and South Europe, North Africa. A well-known medicinal plant, here frequently used as edgings for garden plots. Flowers in their normal state are preferable for medicinal use to those in which the ray-flowers are produced in increased numbers. They contain a peculiar volatile oil, and two acids similar to angelica and valeriana acid.

Anthemis tinctoria, L. — Middle and South Europe, Orient. An annual herb. The flowers contain a yellow dye.

Anthistiria ciliata, L. fil. (*Anthistiria Australis*, R. Brown.) — The well-known Kangaroo Grass, not confined to Australia, but stretching through Southern Asia also, and through the whole of Africa. It is mentioned here because its growth should be encouraged by every means. There are several species of *Anthistiria*, deserving introduction and naturalization in our colony.

Anthoxanthum odoratum, L. — The Scented Vernal Grass. Europe, North and Middle Asia, North Africa. A perennial, not of great value as a fattening

grass, yet always desired for the flavor which it imparts to hay. Perhaps for this purpose the scented *Andropogons* might serve here also. On deep and moist soils it attains its greatest perfection. It is much used for mixing among permanent grasses on pastures, where it will continue long in season. It would live well in our Alps. The lamellar-crystalline Cumarin is the principle on which the odor of *Anthoxanthemum* depends.

Apios tuberosa, Moench. — North America. A climber, with somewhat milky juice. The mealy tubers are edible.

Apium graveolens, L. — The Celery. Europe, North Africa, North and Middle Asia. It is here merely inserted with a view of pointing out that it might be readily naturalized on our sea-shores.

Apium prostratum, La Billardiere. — The Australian Celery. Extra-tropical Australia, New Zealand, extra-tropical South America. This also can be utilized as a culinary vegetable.

Apocynum cannabinum, L. — On river-banks in North America. This is recorded among plants yielding a textile fibre.

Arachis hypogæa, L. — The Earth-nut, Peanut, or Ground-nut. Brazil. The seeds of this annual herb are consumed in a roasted state, or used for pressing from them a palatable oil. The plant is a very productive one, and yields a very quick return. It ranks also as a valuable fodder herb. A light, somewhat calcareous soil is best fitted for its growth. On such soil, 50 bushels may be obtained from the acre.

Archangelica officinalis, Hoffman. — Arctic zone and mountain regions of Europe. The stalks are used for

confectionery; the roots are of medicinal use. Only in our Alps would this herb fully establish its value. The root is biennial, and used in the distillation of some cordials.

Arctostaphylos uva ursi, Sprengel.—Alpine and arctic Europe, North Asia, and North America. A medicinal, small shrub, which here could best be reared in the heath-moors of our Alpine regions.

Argania Sideroxylon, Roem. and Schult.—The Argan-tree. Western Barbary, on dry hills. Its growth is here found to be slow; but it is a tree of longevity. Though comparatively low in stature, its foliage occasionally spreads to a circumference of 220 feet. It sends out suckers from the root. The fruits serve as food for cattle in Morocco; but here the kernels would be more likely to be utilized by pressing the oil from them.

Aristolochia Serpentaria, L.—The Snake-root of North America. The root of this trailing herb is valuable in medicine; it contains a peculiar volatile oil. Several other *Aristolochiæ* deserve culture for medicinal purposes, for instance, *Aristolochia ovalifolia* (Guaco), and *A. anguicida*, from the mountains of Central America, should they prove hardy.

Arnica montana, L.—Colder parts of Europe. This pretty herb is perennial, and of medicinal value. It is eligible for our sub-alpine regions. The active principles are, arnicin, volatile oil, cupron, and capryl acid.

Arracacha xanthorrhiza, Bancroft.—Mountain regions of Central America. An umbelliferous herb. The roots are nutritious and palatable. There are yellow, purple, and pale varieties.

Artemisia Absinthium, L.—The Wormwood. Europe, North and Middle Asia, and North Africa. A perennial herb, valuable as a tonic and anthelmintic. Several other species of *Artemisia* deserve cultivation for medicinal purposes. Active principles: Absinthin, an oily substance, indurating to a crystalline mass; a volatile oil peculiar to the species.

Artemisia Dracunculus, L.—The Tarragon, or Estragon. North Asia. A perennial herb, used as a condiment. The flavor rests on two volatile oils, one of them peculiar to the plant.

Arundinaria falcata, Nees. —Nepaul. One of the hardiest kinds of the Bamboo tribe. It rises to the height of twenty feet, the canes attaining a diameter of four inches.

Arundinaria macrosperma, Michaux. —Southern States of North America, particularly on the Mississippi. This Bamboo-like reed forms there the canebrakes. It requires to be replanted after flowering in the course of years. Height 20 feet.

Arundo Donax, L. —The tall evergreen, lasting Bamboo-reed of South Europe and North Africa. It is one of the most important plants of its class for quickly producing a peculiar scenic effect in picturesque plantations; also, for intercepting at once the view of unsightly objects, and for giving early shelter. The canes can be used for fishing-rods.

Arundo Pliniana, Turr. —On the Mediterranean and Adriatic seas. A smaller plant than *A. Donax*, with more slender stems and narrower leaves, but similarly evergreen, and resembling the *Donax* reed also in its roots.

Arundo saccharoides, F. v. M. (*Gynerium saccha-*

roides, Humboldt.)—Northern parts of South America. This species is here not yet introduced ; but it is likely to prove hardy. Like the following, it is conspicuously magnificent.

Arundo Sellowiana, Schultes. (*Arundo dioica*, Spreng. non Louriero. *Gynerium argenteum*, Nees.)—The Pampas Grass of Uruguay, Paraguay and the La Plata State. A grand autumnal flowering reed, with gorgeous feathery panicles. As an industrial plant it deserves here a place, because paper can be prepared from its leaves.

Asparagus officinalis, L.—Europe, North Africa, North Asia. The well-known *Asparagus* plant, which, if naturalized on our coast, would aid in binding the sand. The foliage contains inosit-sugar ; the shoots contain asparagin.

Astragalus Cephalonicus, Fischer. (*A. aristatus*, Sibthorp.)—Cephalonia. A small shrub, yielding a good tragacanth ; and so probably, also, the true *A. aristatus* of P'Heritier is producing it.

Astragalus Creticus, La Marek.—Candia and Greece. A small bush, exuding the ordinary vermicular tragacanth. The pale is preferable to the brown sort.

Astragalus gummifer, La Billard.—Syria and Persia. This shrub also yields a good kind of tragacanth.

Astragalus strabiliferus, Royle.—Asiatic Turkey. The brown tragacanth is collected from this species.

Astragalus verus, Olivier. — Asiatic Turkey and Persia. This shrub furnishes the Takalor or Smyrna tragacanth, or it is derived from an allied species.

Atriplex hortensis, L.—North and Middle Asia. The Arroche. An annual spinach plant.

Atropa Belladonna, L.—The Deadly Nightshade. South and Middle Europe and Western Asia. A most important perennial medicinal herb. The highly powerful atropin is derived from it, besides another alkaloid, the belladonnin.

Avena fatua, L.—Wild Oat. Europe, North Africa, North and Middle Asia, eastward as far as Japan. The experiments of Professor Buckman indicate that our ordinary culture-oat (*Avena sativa*, L.) is descended from this plant.

Avena flavescens, L. (*Trisetum flavescens*, Beauv.)—Yellowish Oat Grass. Europe, North Africa, Middle and North Asia, eastward as far as Japan. One of the best of perennial meadow-grasses, living on dry soil; fitted also for our Alps.

Avena pratensis, L.—Meadow Oat Grass. Europe, North Asia. It thrives well on dry, clayey soil; it produces a sweet fodder, but not in so great proportion as several other less nutritious grasses. It is perennial, and well adapted for our snowy mountains, where it would readily establish itself, even on heathy moors.

Avena pubescens, L.—Downy Oat Grass. Europe, North and Middle Asia. A sweet perennial grass, requiring dry but good soil, containing lime. It is nutritious and prolific. Several good oat-grasses are peculiar to North America and other parts of the globe. Their relative value as fodder-grasses is in many cases not exactly known, nor does the limit assigned to this little treatise allow of their being enumerated on this occasion.

Bactris Gisipæa, Humboldt. (*Guilielma speciosa*, Mart.)—The Peach Palm of the Amazon River, as-

ending to the warm-temperate regions of the Andes. Stems clustered, attaining a height of 90 feet. Dr. Spruce describes the large bunches of fruits as possessing a thick, firm and mealy pericarp, which, when cooked, has a flavor between potato and chestnut, but superior to either. To us, however, this palm would be mainly an object of grandeur. It is likely to endure our clime in the fern-tree gullies.

Bambusa arundinacea, Roxb.—The Thorny Bamboo of India. It requires a rich, moist soil, and delights on river-banks. It is of less height than *Bambusa vulgaris*; it also sends up from the root numerous stems, but with bending branches, thorny at the joints. The seeds of this and some other bamboos are useful as food for fowls.

Bambusa attenuata, Thwaites.—The Hardy Bamboo of Ceylon, there growing on the mountains at elevations between 4,000 to 6,000 feet. It attains a height of 25 feet.

Bambusa elegantissima, Hasskarl.—Java, on mountains, about 4,000 feet high. Very tall, and exceedingly slender; the upper branches pendulous. A hardy species.

Bambusa monadelpha. (*Dendrocalamus monadelphus*, Thwaites.)—Ceylon, on mountains, from 4,000 to 6,000 feet high. A dwarf but handsome bamboo, reaching only a height of 12 feet.

Bambusa spinosa, Roxb.—Bengal. A bamboo of considerable height. The central cavity of the canes is of less width than in most other species; thus the strength for many technic purposes is increased.

Bambusa stricta, Roxb.—India, particularly Bengal. Grows on drier ground than *B. arundinacea*. It

is also smaller, and quite straight. Its strength and solidity render it fit for many select technic purposes.

Bambusa verticillata, Blume.—The Whorled Bamboo of Java.

Bambusa vulgaris, Wendland.—The large, unarmed bamboo of Bengal. It attains a height of 70 feet, and stems may attain even a length of 40 feet in one season, though the growth is slower in our clime. It has proved to be capable of resisting the occasional night frost of the lowlands of Victoria. It is the best for building bamboo houses. Immersion in water for some time renders the cane still firmer. To the series of large, thornless bamboos belong, also, *Bambusa Tulda*, and *Bambusa Balcooa*, of India, and *Bambusa Thoursii*, from Madagascar and Bourbon. These bamboos are much used for various kinds of furniture, mats, implements, and other articles. There are many other kinds of bamboo eligible among the species from China, Japan, India, tropical America, and, perhaps, tropical Africa. One occurs in Arnheim's Land.

Barosma serratifolia, Willd.—South Africa. This shrub supplies the medicinal bucco-leaves. *B. crenulata*, Hook (*Diosma crenulata*, L.) is only a variety of this species. Active principles: A peculiar volatile oil, a peculiar resin, and a crystalline substance called Diosmin.

Beta vulgaris, L.—The Beet or Mangold root. Middle and South Europe, Middle Asia, North Africa. This well-known perennial or biennial herb ought to engage the general and extensive attention of our farming population. The herb is most valuable as a palatable and nutritious spinach; the root is of im-

portance not only as a culinary vegetable, but, as well known, also for its content of sugar, fit to be crystallized. That of beet, indeed, is now almost exclusively consumed in Russia, Germany, Austria, France, Sweden, and Belgium; and these countries not only produce the beet sugar, but also export it largely to the neighboring States. The white Sicilian beet is mainly used for salads, spinach, and soups. The thick-ribbed variety serves like asparagus or sea-kale, dressed like rhubarb. Cereal soil, particularly such as is fit for barley, is generally adapted also for the culture of beet. The rearing of the root and the manufacture of the sugar can be studied from manifold works; one has been compiled by Mr. N. Levy, of this city. A deeply-stirred, drained soil, rich in lime, brings the saccharine variety of beet to the greatest perfection. The imperial beet yields from 12 to 20 per cent. sugar. The Castelnauderry, the Madgeburg, the Siberian Whiterib, and the Vilmorin beet are other varieties rich in sugar. About five pounds of seeds are required for an acre. In rotation of crops the beet takes its place best between barley and oats. In Middle Europe the yield averages 14 tons of sugar beet to the acre, and as many hundred weight of raw sugar. The mercantile value of the root, at our distilleries, ranged from 20s. to 30s. per ton. In our clime the beet harvest can be extended over a far longer time of the year than in Middle Europe. The extraction of the sap is effected generally by hydraulic pressure. The juice is purified with lime and animal coal. Excess of lime is removed by carbonic acid, and the purified and decolorized juice is evaporated in vacuum pans, with a view to prevent-

ing the extensive conversion of the crystallisable sugar into treacle. The production of beet-sugar needs far less labor than that of cane-sugar, and the harvest is obtained in so short a time as eight months. Beet has shown itself subject neither to alarming diseases nor to extensive attacks of insects. Beet is grown in extra-tropical zones like ours, while the sugar-cane is a plant confined to tropical and sub-tropical latitudes. Beet culture, by directly or indirectly restoring the refuge, ameliorates the soil to such an extent that, in some parts of Germany, land so utilized has risen to fourfold its former value. Beet, furthermore, affords one of the most fattening stable fodders, and thus again an ample supply of manure. In middle Europe now about one sixth of all the arable land is devoted to beet, yet the produce of cereals has not become reduced, while the rearing of fattened cattle has increased. Notwithstanding a heavy tax on the beet-sugar factories in Europe, the industry has proved prosperous, and assumes greater and greater dimensions. In 1865, the sugar consumption of Europe amounted to 31,676,497 cwt., one third of which had been locally supplied by the beet, from over one thousand beet-sugar factories. Treacle obtained from beet is distilled for alcohol. For establishing remunerative factories on a large and paying scale, it has been suggested that farmers' companies might be formed. For ascertaining the percentage of sugar in beet, saccharometers are used. In Germany, some scientific periodicals are exclusively devoted to the fostering of this industry.

Boehmeria nivea, Gaudichaud. — The Ramie or Rhea. Southern Asia, as far east as Japan. This

bush furnishes the strong and beautiful fibre woven into the fabric, which inappropriately is called grass-cloth. The bark is softened by hot water or steam, and then separable into its tender fibres. The best is obtained from the young shoots; it is glossy, tough, and lasting, combining to some extent the appearance of silk with the strength of flax. The ordinary market value of the fibre is about £40 per ton; but Dr. Royle mentions that it has realized, at times, £120. The seeds are sown on manured or otherwise rich and friable soil. In the third year, or under very favorable circumstances even earlier, it yields its crops, as many as three annually. The produce of an acre has been estimated at two tons of fibre. This latter, since Kaempfer's time, has been known to be extensively used for ropes and cordage in Japan. Our rich and warmest forest valleys seem best adapted for the Ramie, as occasional irrigation can be also there applied. In the open grounds of Victoria it suffers from the night frosts, although this does not materially injure the plant, which sends up fresh shoots, fit for fibre, during the hot season. The plant has been cultivated and distributed since 1854, in the Botanic Garden of Melbourne, where it is readily propagated from cuttings, the seeds ripening rarely there. Cordage of this *Boehmeria* is three times as strong as that of hemp. Other species require to be tested, among them the one which was recently discovered in Lord Home's Island, namely, *Boehmeria calophleba*.

Boronia megastigma, Nees. — In West Australia, on margins of swamps. This remarkable bush is recorded here as an emblem of mourning, its external blackish flowers rendering it especially eligible for

graves. Industrially, it interests us on account of its powerfully-fragrant blossoms, for the sake of which this bush will deserve to be cultivated. The scent might be extracted by Mr. Bosisto's process.

Borrago officinalis, L.—South Europe, Orient. An annual herb, occasionally used for medicinal purposes or as an admixture to salad.

Brabejum stellatifolium, L.—South Africa. The nuts of this shrub are edible, resembling those of our *Macadamia ternifolia*, to which also in foliage and flowers *Brabejum* is closely allied. The nuts are also similar to those of the Chilian *Guevina Avellana*.

Brassica alba, Visiani. (*Sinapis alba*, L.)—White Mustard. Europe, North Africa, North and Middle Asia. An annual. The seeds are less pungent than those of the Black Mustard, but used in a similar manner. The young leaves of both are useful as a culinary and anti-scorbutic salad. Dr. Masters enumerates *Brassica Chinensis*, *B. dichotoma*, *B. Pekinensis*, *B. ramosa*, and *B. glauca*, among the mustards which undergo cultivation in various parts of Asia, either for the fixed oil of their seeds or for their herbage. From 15 lbs. to 20 lbs. of seeds of the white mustard are required for an acre. In the climate of California, similar to ours, 1,400 lbs. of seeds have been gathered from an acre.

Brassica nigra, Koch. (*Sinapis nigra*, L.)—The Black Mustard. Europe, North Africa, Middle Asia. An annual. The seeds, simply crushed and then sifted, constitute the mustard of commerce. For medicinal purposes the seeds of this species are preferable for sinapism and other purposes. In rich soil this plant is very prolific; and in our forest-valleys it is

likely to remain free from the attack of aphid. Chemical constituents : a peculiar fixed oil, crystalline sinapin, the fatty sinapisin, Myron-acid and Myrosin.

Brassica oleracea, L.—An annual or biennial coast-plant, indigenous to various parts of Europe. it is mentioned here with a view of showing that it might be naturalized on our rocky and sandy sea-shores. From the wild plant of the coast originated various kinds of cabbages, brocoli, cauliflower, Brussel sprouts, kale, kohlrabi, etc. Other races of this species are collectively represented by *Brassica Rapa*, L. (*B. campestris*, L.), the Wild Navew, yielding most of the varieties of turnips, some with other cultivated forms transferred to us from ancient times. Again other varieties are comprehended within *Brassica Napus*, L., such as the Swedish and Teltower turnips, while the rape seed, so important for its oil (Colza), is also derived from a form of *B. Napus*. The rape should be produced here as an agrarian produce, giving a rapid return, wherever it should remain free of aphid. The hardier turnips could be produced on our highest Alps, as they are grown still within the arctic circle, and, according to Dr. J. Hooker, at a height of 15,000 feet in the Himalaya mountains.

Butomus umbellatus, L.—The Flowering Rush. Europe, North and Middle Asia. This elegant perennial water-plant is mentioned here more for its value in embellishing our lakes and water-courses than for the sake of its roots. The latter, when roasted, are edible. The plant would live in our sub-alpine rivulets.

Bromus unioloides, Humboldt.* (*B. Schraderi*, Kunth.)—Here called the Prairie Grass. From Cen-

tral America it has spread over many parts of the globe. The writer saw it disseminated in the mountains of St. Vincent's Gulf as early as 1847. It is one of the richest of all grasses, grows continuously and spreads readily from seeds, particularly on fertile and somewhat humid soil, and has proved as a lasting and nutritious fodder-grass or pasture-grass one of our best acquisitions.

Broussonetia papyrifera, Ventenat. — The Paper Mulberry. Islands of the Pacific Ocean, China, Japan, perhaps only truly indigenous in the last-named country. The bast of this tree or shrub can be converted into very strong paper. It can also be used as a textile fabric; furthermore, the fabrics made from it can be dressed with linseed oil for waterproof coverings. In cultivation the plant is kept like an osier. The leaves cannot be used for silkworms. European fabrics have largely superseded the clothing made of this plant in the South Sea Islands.

Caesalpinia Gilliesii, Wallieh. (*Poinciana Gilliesii* Hooker.)—La Plata States. This beautiful hardy bush can be utilized for hedges.

Cajanus Indicus, Candolle. — The Catjang; in Assam called Gelooa-mah. A shrubby plant of India, probably available for profitable culture and naturalization in the warmer parts of our colony. It sustains itself on dry ground, and yields the pulse known as dhal, urhur, and Congo-pea. The plant lasts for about three years. Several species of *Cajanus* of the *Atylosia* section, indigenous to the warmer parts of Australia, might be tested here for the sake of the economic value of their seeds. The insect, active in the formation of lac, lives extensively on the Caja-

nus, according to Mr. T. D. Brewster, of Assam. Silkworms also live on it.

Calamus montanus, T. Anderson. — Himalaya, up to 6,000 feet. A hardy, climbing palm. The aged canes are naked. "The light but strong suspension bridges, by which the large rivers of Sikkim are crossed, are constructed of this palm. It supplies material for the strongest ropes for dragging logs of wood from the forests. The most durable baskets and the cane-work of chairs are manufactured from the slit stems. Walking-sticks and riding-canes made of this species are exported from Sikkim in considerable quantity." Many other Calami serve similar purposes, but probably few or perhaps none are equally hardy.

Camelina sativa, Crantz. — Middle and South Europe, temperate Asia. An annual herb, cultivated for the sake of its fiber and the oil of its seeds. It is readily grown after corn-crops, yields richly even on poor soil, and is not attacked by aphids. Mr. W. Taylor obtained 32 bushels of seeds from an acre, and from these 540 pounds of oil. The return is within a few months.

Canna Achiras, Gillies. — Mendoza. One of the few extra-tropic cannas, eligible for arrow-root culture.

Canna coccinea, Roscoe. — West India. Yields, with some other cannas, the particular arrow-root called "Tous les mois."

Canna edulis, Edwards. — The Adeira of Peru. One of the hardiest of arrow-root plants, and thus well adapted for our clime. Seeds, even if many years old, will germinate. This species has yielded excellent starch at Melbourne, Western Port, Lake Wel-

lington, Ballarat, and other localities, from plants supplied at the Botanic Garden. The Rev. Mr. Hagenauer, of the Gipps Land Aboriginal Mission station, obtained 220 pounds of arrow-root from one eighth of an acre of this *Canna*. The gathering of the roots is effected about April. The plants can be set out in ordinary plowed land. Captain James Hall, of Hastings, prepared also largely the starch from this root. Starch grains remarkably large.

Canna flaccida, Roscoe. — Carolina. Probably also available for arrow-root, though in the first instance, like many congeners, chosen only for ornamental culture.

Canna glauca, Linne. — One of the West Indian arrow-root cannas.

Cannabis sativa, L.* — The Hemp-plant. Indigenous to various parts of Asia, as far west as Turkey and as far east as Japan. Cultivated for its fiber since ancient times. Particularly in hot climes it exudes the "Churras," a resinous substance of narcotic, intoxicating property. The foliage contains also a volatile oil, which the seeds yield by pressure — the well-known fixed hemp-oil. The staminiferous plant is pulled for obtaining the fiber in its best state, immediately after flowering; the seeding plant is gathered for fiber at a later stage of growth. Good soil, well drained, never absolutely dry, is needed for successful hemp-culture. Hemp is one of the plants yielding a full and quick return within the season. The Summer temperature of St. Petersburg (67° F.) and of Moscow (62° F.) admit yet of the cultivation of this plant.

Capparis spinosa, L. — South Europe and North Af-

rica. A somewhat shrubby and trailing plant, deserving even for the sake of its handsome flowers a place in any garden. It sustains its life in the most arid deserts. The frosts of our lowlands do not destroy this plant. The flower-buds and young berries preserved in vinegar, with some salt, form the capers of commerce. Samples of capers, prepared from plants of the Botanic Garden, are placed in our Industrial Museum, together with many other industrial products emanating from the writer's laboratory. A closely-allied and probably equally useful plant, *Capparis nummularia*, is indigenous to Northern Australia. The Caper-plant is propagated either from seeds or suckers; it is well able to withstand either heat or drought. The buds after their first immersion into slightly-salted vinegar are strained and afterward preserved in bottles with fresh vinegar. Chemical principle: glycosid.

Capsicum annuum, L.—Central America. An annual herb, which yields the Chillies and thus also the material for Cayenne Pepper. Chemical principle: capsin, an acrid, soft, resinous substance.

Capsicum baccatum, L.—The Cherry-Capsicum. A perennial plant. From Brazil brought to tropical Africa and Asia, where now other Pepper-Capsicums are likewise naturalized.

Capsicum frutescens, L.—Tropical America. The berries of this shrubby species are likewise converted into cayenne pepper.

Capsicum longum, Candolle.—Some of the hottest parts of America. An annual herb, also yielding cayenne pepper. Our Summers admit of the successful growth of at least the annual species of *Capsicum* in all the lowlands.

Carthamus tinctorius, L.—From Egypt to India. The Safflower. A tall, annual, rather handsome herb. The florets produce yellow, rosy, ponceau and other red shades of dye, according to various admixtures. Pigment principles: carthamin and carthamus-yellow. For domestic purposes it yields a dye ready at hand from any garden. In India the *Carthamus* is also cultivated for the sake of the oil, which can be pressed from the seeds.

Carum Ajowan, Benth. (*Ptychotis Ajowan*, Candolle.)—India. The fruits of this annual herb form an excellent culinary condiment, with the flavor of thyme. Its peculiar oil is accompanied by cymol and Thymol.

Carum Carui, L.—The Caraway-plant. Perennial. Europe, North and Middle Asia. It might be naturalized in our Alps and also along our sea-shores. The Caraway-oil is accompanied by two chemical principles: carven and carvol.

Carum ferulifolium, Koch. (*Bunium ferulifolium*, Desfont.)—A perennial herb of the Mediterranean regions. The small tubers are edible.

Carum Petroselinum, Benth. (*Apium Petroselinum*, L.)—The Parsley. The biennial well-known herb, indigenous to South Europe and the Orient. Essential oil peculiar with Stearopten.

Caryota urens, L.—India. One of the hardier Palms, ascending, according to Dr. Thomas Anderson, the Himalayas to an altitude of 5,000 feet, yet even there attaining a considerable height, though the temperature sinks in the cooler season to 40° Fahrenheit. The trunk furnishes a sago-like starch. This Palm flowers only at an advanced age, and after having pro-

duced a succession of flowers dies away. From the sap of the flowers toddy and palm-sugar are prepared, like from the Cocos and Borassus Palm, occasionally as much as 12 gallons of toddy being obtained from one tree in a day. The fibre of the leaf-stalks can be manufactured into very strong ropes, also into baskets, brushes, and brooms. The outer wood of the stem serves for turnery.

Cassia acutifolia, Delile.—Indigenous or now spontaneous in northern and tropical Africa, and South-west Asia. Perennial. The merely dried leaflets constitute part of the Alexandrian and also Tinnevely senna. In Victoria, it will be only in the warmest northern and eastern regions where senna can, perhaps, be cultivated to advantage.

Cassia augustifolia, Vahl.—Northern Africa and South-western Asia; indigenous or cultivated. Perennial. Yields Mecca senna.

Cassia Marylandica, L.—An indigenous senna-plant of the United States of America. Perennial.

Cassia obovata, Colladon.—South-west Asia; widely dispersed through Africa as a native or disseminated plant. Perennial. Part of the Alexandrian, and also Aleppo Senna is derived from this species. Several of the Australian desert Cassias, of the group of *C. artemisioides*, may also possess purgative properties. The odor of their foliage is almost that of senna.

Catha edulis, Forskoel.—Arabia and Eastern Africa. The leaves of this shrub, under the designation Kafta or Cat, are used for a tea of a very stimulating effect, to some extent to be compared to that of *Erythroxylon Coca*. To us here the plant would be mainly valuable for medicinal purposes.

Cedronella cordata, Benth. —United States of North America. A perennial herb, fragrant, like the foregoing.

Cedronella triphylla, Moench. —Madeira and Canary Islands. A shrubby plant, with highly-scented foliage. The volatile oil obtainable from it resembles that of *Melissa*, but is somewhat camphoric.

Cephaelis Ipecacuanha, Richard. —Brazil ; in woods of mountains consociated with palms and fern-trees. It is not unlikely that this herb, which is perennial and yields the important medicinal ipecacuanha root, would live in our warmer forest regions, such as those of East Gipps Land. Active principles : emetin and ipecacuanha acid.

Ceroxylon andicola, Humboldt. —The Wax Palm of New Granada, ascending the Andes to 11,000 feet. One of the most majestic and, at the same time, one of the most hardy of all palms, attaining a height of 180 feet. The trunk exudes a kind of resinous wax, about 25 pounds being obtainable at a time from each stem ; this, by admixture to tallow, is used for candles. There are several other andine palms which could be reared in our forests, or in sheltered positions at our dwellings, but some of them are not even yet phytographically circumscribed.

Cervantesia tomentosa, Ruiz and Pavon. —Forest mountains of Peru. This tree yields edible seeds. It is likely to prove hardy in our lower forest regions.

Chærophyllum bulbosum, Linne. —Middle Europe and Western Asia. The Parsnip-Chervil. A biennial herb. The root a good culinary esculent.

Chærophyllum sativum, Lamarek. (*Anthriscus Cerefolium*, Hoffm.) —The Chervil. Middle and

South Europe, Western Asia. An annual herb, available for salads and condiments, but the root deleterious.

Chamærops excelsa, Thunberg.—South China. This fan-palm is highly desirable, although not tall, as the name would indicate.

Chamærops Fortunei, Hooker.—North China. The Chusan palm. It attains a height of about 12 feet, and endures, like the following species, considerable frost. The leaves can be employed for plaiting palm hats. Other hardy palms might be naturalized and used for various purposes, irrespective of their ornamental features.

Chamærops humilis, Linne.—The dwarf Fan-Palm of South Europe and North Africa. It is very decorative for garden plantations; particularly also eligible for scenic effect.

Chamærops Hystrix, Fraser.—The Blue Palmetto of Florida and Carolina. Another dwarf Fan-Palm.

Chamærops Martiana, Wallich.—Ascends mountains of Nepal to 5,000 feet. Attains a height of 50 feet, and is altogether a noble object.

Chamærops Richiana, Griffith.—Arid mountains of Affghanistan. Has also proved hardy even in England.

Chelidonium majus, L.—Europe and Western Asia. The Celandine. A perennial herb of medicinal value. Chemical principles: chelerythrin and chelidinin; also a yellow pigment; chelidoxanthin.

Chenopodium ambrosioides, L.—Tropical America. An annual medicinal herb. *Chenopodium anthelminticum* is a perennial variety of this species.

Chenopodium auricomum, Lindley.—From the Dar-

ling River to Carpentaria and Arnheim's Land. A tall perennial herb, furnishing a nutritious and palatable spinach. It will live in arid, desert regions.

Chenopodium Quinoa, Willdenow. — From New Granada to Chile. A large-leaved, quick-growing annual species, cultivated for the sake of its amylaceous seeds, but perhaps of more value as a culinary vegetable.

Cicer arietinum, L. — South Europe and Orient. The Gram. An annual herb, valuable as a pulse for pasture animals. The seeds can also be converted into pea-meal, or be used otherwise for culinary purposes.

Cichorium Endivia, L. — South Europe, Orient, Middle Asia. A biennial plant, used since ancient times as a culinary vegetable.

Cichorium Intybus, L. — Chicory. A well-known perennial plant, indigenous to Europe, North Africa, and North and West Asia. The roots can be used as a substitute for coffee. This plant requires a rich, deep, loamy soil, but fresh manure is detrimental to the value of the root. It is also a good fodder-plant, especially for sheep. The root can also be dressed and boiled for culinary purposes. The leaves useful for salad.

Cimicifuga racemosa, Elliot. — The Black Snake-root of North America. A perennial herb of medicinal value, the root possessing emetic properties.

Cinchona Calisaya, Ruiz. — Yellow Peru-bark tree. Andes of Peru and Bolivia, 5,000 to 6,000 feet above the ocean. This tree attains a height of 40 feet. It yields the yellow bark, and also part of the crown-bark. It is one of the richest yielders of quinine, and produces, beside, cinchonidin.

Cinchona micrantha, Ruiz and Pavon.—Cordilleras of Bolivia and Peru. This tree attains a height of 60 feet, and from it part of the gray and Huanuco bark as well as Lima bark are obtained. It is comparatively rich in cinchonin and quinidin; contains, however, also quinine.

Cinchona nitida, Ruiz and Pavon.—Andes of Peru and Ecuador. This tree rises to 80 feet under favorable circumstances. It also yields gray-bark and Huanuco-bark, besides Loxa-bark. It will probably prove one of the hardiest species. It contains predominantly cinchonin and quinidin.

Cinchona officinalis, L. (partly)*. (*Cinchona Candaminea*, Humboldt.)—Andes of New Granada and Peru, at a height of 6,000 to 10,000 feet. Yields crown or brown Peru-bark, besides part of Loxa-bark. Comparatively rich in quinine and cinchonidin. The temperature of the middle regions of the Andes, where this tree grows, is almost the same as that of the Canary Islands. Superabundance of moisture is particularly to this species pernicious. The crispilla variety endures a temperature occasionally as low as 27 degrees F.

Cinchona clancifolia mutis is considered by Weddell a variety of *C. officinalis*. This grows on places where the mean annual temperature is that of Rome, with however less extremes of heat and cold. It yields part of the Pitaya-bark.

Cinchona Pitayensis must also be referred to *C. officinalis* as a variety. This attains a height of 60 feet and furnishes also a portion of the Pitaya Bark. It is this particular *Cinchona* which, in Upper India, yielded in some instances the unprecedented quantity

of 11 per cent. alkaloids, nearly 6 per cent. quinine, the rest quinidin and cinchonin.

■ In Java some of the best results were obtained with *Cinchona Hasskarliana*, Miq., a species seemingly as yet not critically identified.

Cinchona succirubra, Pavon.—Middle andine regions of Peru and Ecuador. A tree attaining a height of 40 feet, yielding the red Peru-bark, rich in quinine and cinchonidin. It is this species which is predominantly cultivated on the mountains of Bengal. All these chinchonas promise to become of importance for culture in the warmest regions of our forest-land, on places not readily accessible or eligible for cereal culture. The Peruvian proverb that *Cinchona*-trees like to be "within sight of snow" gives some clue of the conditions under which they thrive best. They delight in the shelter of forests, where there is an equable temperature, no frost, some humidity at all times both in air and soil, where the ground is deep and largely consists of the remnants of decayed vegetable substances, and where the sub-soil is open. Drillage from shelter-trees too near will be hurtful to the plants. Closed valleys and deep gorges, into which cold air will sink, are also not well adapted for *cinchona*-culture. In our colony, we ought to consociate the Peru-bark plants with naturally growing fern-trees, but only in our warmest valleys of richest soil. The best temperature for *Cinchonas* is from 53 degrees to 66 degrees F.; but they mostly will endure in open places a minimum of 32 degrees F.; in the brush shades of the Botanic Garden of Melbourne, where years ago already *Cinchonas* were raised by the thousands, they have even resist-

ed uninjured a temperature of a few degrees less, wherever the wind had no access, while under such very slight cover the Cinchonas withstood also a heat of a few degrees over 100 degrees F. The plants are most easily raised from seeds, best under some cover, such as mats, and they are seeding copiously already several years after planting. The contents of alkaloids in the bark can be much increased by artificial treatment, if the bark is only removed on one side of the stem and the denuded part covered with moss, under which in one year as much bark is formed as otherwise requires three years' growth, such forced bark moreover containing the astounding quantity of as much as 25 alkaloids, because no loss of these precious substances takes place by gradual disintegration through age. The Cinchona-plants are set out at distances of about 6 feet. The harvest of bark begins in the fourth or fifth year. The price varies in Europe from 2s. to 9s. per lb., according to quality. The limits assigned to this small literary compilation do not admit of entering further into details on this occasion, but I may yet add, that in the Darjeeling district over three millions of Cinchona-plants were in cultivation in 1869, raised in government plantations.

Citrus Aurantium, L.*—The Orange (in the widest sense of the word). A native of South Asia. A tree of longevity, known to have attained an age of 600 years and more. Any specific differences, to distinguish *C. aurantium* from *C. medica*, if they once existed, are obliterated now through hybridization, at least in the cultivated forms. As prominent varieties of *C. aurantium* may be distinguished :

Citrus Bigaradia, DuRoi.—The Bitter Orange.

This furnishes from its flowers the Neroli oil so delicious and costly as a scent. It is stated that orange-flowers to the value of £50 might be gathered from the plants of an acre within a year. The rind of the fruit is used for candied orange-peel. Bitter principle : hesperidin in the rind, limonin in the seed.

Citrus dulcis, Volkamer. — The Sweet Orange, of which many kinds occur. The St. Michael Orange has been known to bear in the Azores, on sheltered places, 20,000 fruits on one tree in a year. Neroli oil is obtained from the flowers of this and allied varieties.

Citrus Bergamium, Risso. — From the fruit-rind of this variety bergamot oil is obtained, but also oil from the flowers. The Mellarosa variety furnishes a superior oil and exquisite confitures.

Citrus decumana, Linne. — The Shaddock or Pom-pelmos. The fruit will exceptionally attain a weight of 20 pounds. The pulp and thick rind can both be used for preserves.

Citrus nobilis, Loureiro. — The Mandarin Orange. The thin peel separates most readily from the deliciously - flavored sweet pulp. There are large and small fruited Mandarin oranges ; the Tangerine variety is one of them.

Citrus medica, Linne.* — The Citron (in the widest sense of the word). Indigenous to Southern Asia. For convenience sake it is placed here as distinct from the preceding species. As prominent varieties of the *Citrus medica* may be distinguished :

Citrus Cedra, Galesio. — The real Citron. From the acid tubercular fruit essential oil and citric acid can be obtained, irrespective of the ordinary culinary use

of the fruit. A large variety with thick rind furnishes, candied, the Citrionate or Succade. The Cedra oil comes from a particular variety.

Citrus Limonium, Risso.—The real Lemon. From the fruit of this is largely pressed the lemon-juice, while the thin, smooth, aromatic peel serves for the production of volatile oil or for condiments. The juice of this fruit is particularly rich in citric acid. A large variety is the Rosaline lemon.

Citrus Lumia, Risso.—The sweet Lemon, including the Pear Lemon with large pear-shaped fruit. Rind thick and pale; pulp not acid. This variety serves for particular condiments.

Citrus Limetta, Risso.—The real Lime. The best lime-juice is obtained from this variety, of which the Perette constitute a form.

Citrus Australasica, F. von Mueller.—Coast forests of extra-tropic East Australia. A shrubby species with oblong or almost cylindrical fruits of lemon-like taste, measuring 2 to 4 inches in length. They are thus very much larger than those of *Atalantia glauca* of the coast and the desert-interior of tropic Australia, which are also of similar taste. These plants are entered together with the following on this list, merely to draw attention to them, as likely capable of improvement of their fruit through culture.

Citrus Planchoni, F. von Mueller. (*C. Australis*, Planchon, partly.)—Forests near the coast of sub-tropic East Australia. A noble tree, fully 40 feet high, with globular fruits about the size of a walnut, called Native oranges. The species has first appeared under the above name in the "Report on the Vegetable Products of the Intercolonial Exhibition of 1867."

Citrus Japonica, Thunberg.—The Kumquat of Japan. A shrubby *Citrus* with fruits of the size of a gooseberry, from which, on account of their sweet peel and acid pulp, an excellent preserve can be prepared.

Cochlearia Armoracia, L.—The Horseradish. Middle Europe and Western Asia. Perennial. The volatile oil of the root allied to that of mustard.

Cochlearia officinalis, L.—Shores of Middle and North Europe, North Asia, and North America. A biennial herb, like the allied *C. anglica* and *C. danica*, valuable as an anti-scorbutic; hence deserving naturalization. It contains a peculiar volatile oil.

Coffea Arabica, L.—Mountains of South-west Abyssinia. The Coffee-plant. This shrub or small tree has been admitted into this list not without great hesitation, merely not to be passed. The cultivation within Victorian boundary can only, with any prospect of success, be tried in the warmest and simultaneously moistest regions, such as East Gipps Land, frost being detrimental to the coffee-plant. In Ceylon, the coffee regions are between 1,000 and 5,000 feet above the ocean; but Dr. Thwaites observes that the plant succeeds best at an elevation of 3,000 to 4,500 feet, in places where there is a rain-fall of about 100 inches a year. The temperature there rises hardly ever above 80 degrees F., and almost never sinks below 45 degrees F. Coffee requires moist weather while it ripens its fruit, and a season of dryer weather to form its wood. For further particulars see the papers of the Planters' Association of Kandy. Chemical principles: coffein, a peculiar tannic acid, and quina acid.

Colchicum auctumnale, L.—Middle and South Eu-

rope, West Asia. The Meadow Saffron. The seeds and roots of this pretty bulbous-tuberous herb are important for medicinal use. The plant has been introduced by the writer with a view of being cultivated on moist meadows in our ranges. Active principle : colchicin.

Colocasia antiquorum, Schott. — Egypt, through South Asia to the South Sea Islands; apparently also indigenous in the warmer parts of East Australia. The Taro. The stem-like tuberous, starchy roots lose their acidity by the process of boiling, roasting, or baking. The plant proved hardy in the Botanic Garden of Melbourne. The tops of the tubers are replanted for a new crop. Taro requires a rich, moist soil, and would grow well on banks of rivers. For scenic culture it is a very decorative plant. *Colocasia esculenta* is a variety of this species.

Colocasia Indica, Kunth. (*Alocasia Indica*, Schott.) — South Asia, South Sea Islands, and East Australia. Cultivated for its stem and tubers on swamps or rivulets. This stately plant will rise, in favorable localities, to a height of 12 feet, the edible trunk attaining a considerable thickness, the leaves sometimes measuring 3 feet in length. In using the stem and root for food great care is needed to expel, by the heating process, all acidity. *Colocasia odora* and *C. macrorrhiza* seem varieties of this species. Several other aroid plants deserve attention for test-culture on account of their edible roots, among them *Cyrtosperma edulis*, Seemann, from the Fiji Islands.

Conium maculatum, L. — The Hemlock. Europe, North Africa, North and West Asia. A biennial herb, important for medicinal purposes. It should, however,

not be allowed to stray from its plantations, as it is apt to be confounded with culinary species of *Anthriscus*, *Chærophyllum*, and *Myrrhis*, and may thus cause, as a most dangerous plant, disastrous mistakes. Active principles: coniin; in the fruit also conhydrin.

Conopodium denudatum, Koch.—Western Europe. The small tuberous roots of this herb, when boiled or roasted, are available for food, and known as earth chestnuts. The plant is allied to *Carum Bulbocastanum*.

Convolvulus floridus, L. fil.—Canary Island. A shrubby, not climbing or winding species. With the following it yields the Atlantic rosewood from stem and root.

Convolvulus scoparius, L. fil.—Teneriffe. One of the rosewood plants.

Convolvulus Scammonia, L.—Mediterranean regions and Asia Minor. A perennial herb. From the root is obtained the purgative resin scammonia.

Corchorus capsularis, L.—From India to Japan. One of the principal jute plants. An annual, attaining a height of about a dozen feet, when closely grown, with almost branchless stem. A nearly allied but lower plant, *Corchorus Cunninghami*, F. v. Muel-ler, occurs in tropical and sub-tropical East Australia. Jute can be grown where cotton and rice ripen, be it even in localities comparatively cold in the Winter, if the Summer's warmth is long and continuous. The fibre is separated by steeping the full-grown plant in water from five to eight days, and it is largely used for rice and cotton-bags, carpets and other similar textile fabrics, and also for ropes. About 60,000 tons are annually exported from India to England, and a

large quantity also to the United States. Jute is sown on good land, well plowed and drained, but requires no irrigation, although it likes humidity. The crop is obtained in the course of four or five months, and is ripe when the flowers turn into fruit capsules. Good paper is made from the refuse of the fibre.

Corchorus olitorius, L. — South Asia and North Australia. Furnishes, with the foregoing species, the principal supply of jute fibre. As it also is an annual, it can be brought to perfection in our Summers. The foliage can be used for spinach. The fibre is not so strong as hemp, but very easily prepared. It will not endure exposure to water. The allied *Corchorus trilocularis*, L., of Indian origin, is likewise a native of eastern tropical and sub-tropical Australia.

Cordyline Banksii, J. Hooker. — New Zealand. This lax and long-leaved palm lily attains a height of 10 feet; its stem is usually undivided. This and the following species have been admitted into this list for a double reason, because not only are they by far the hardiest, quickest-growing, and largest of the genus, and thus most sought in horticultural trade for scenic planting; but also because they furnish from the leaves a superior fibre for ropes and other purposes. The small seeds are produced in great abundance, and germinate with extreme readiness. These palm lilies ought to be naturalized in our ranges by mere dissemination.

Cordyline Forsteri, F. v. Mueller. (*C. Australis*, J. Hooker, not Endlicher.) — New Zealand. The stem of this noble, thin-leaved plant attains a height of 40 feet, and is branched.

Cordyline indivisa, Kunth. — New Zealand. The

stem of this thick and rigid-leaved palm-like species rises to a height of 20 feet, and remains undivided. Leaves finally 5 inches broad ; yield the toi-fibre.

Cordyline Baueri, J. Hooker. (*C. Australis*, Endlicher, not J. Hooker.)—Norfolk Island. The stem of this stately species attains a height of 40 feet, and becomes, in age, ramified. It is very intimately allied to the New Zealand *Cordyline Forsteri*.

Cortandrum sativum, L.—Orient and Middle Asia. An annual or biennial herb, much in use for condiments. The essential oil peculiar.

Corynosicyos edulis. (*Cladosicyos edulis*, J. Hooker.)—Guinea. A new cucumber-like plant, with edible fruits about 1 foot long and 3 inches in diameter.

Crambe maritima, L. —Sea-kale. Sand coasts of Europe and North Africa. A perennial herb ; the young shoots used as a wholesome and agreeable vegetable.

Crambe Tartaria, Wulfen.—From Southern Europe to the Orient. Perennial. Likewise used for culinary purposes.

Cratægus æstivalis, Torrey and Gray.—The Apple Haw. Southern States of North America. The small, juicy fruit of an agreeable acid taste.

Cratægus apiifolia, Michaux. — North America. Highly serviceable for hedges.

Cratægus coccinea, L. — North American White-thorn. A valuable hedge-plant ; also very handsome. Spines strong.

Cratægus cordata, Aiton.—Southern States of North America. Also much employed for hedges.

Cratægus Crus-Galli, L. — North America. The Cockspur Thorn. Regarded as one of the best species for hedges. Spines long and stout.

Cratægus Oxyacantha, L.—Europe, North Africa, North and West Asia. The ordinary hawthorn or Whitethorn. Recorded here as one of the most eligible among deciduous hedge-plants.

Cratægus parvifolia, Aiton.—North America. For dwarf hedges. Spines long, slender, sharp, and numerous.

Cratægus pyracantha, Persoon. — The Firethorn. South Europe. This species is evergreen. It is likewise adapted for hedges, but slower in growth than hawthorn, but not difficult to rear.

Cratægus tomentosa, L. — North America. Fruit edible. By the species mentioned the list of American hedgethorns is, probably, not yet exhausted.

Crithmum maritimum, L.—The real Samphir. Seashores of Middle and South Europe, North Africa, and the Orient. A perennial herb. Settlers on the coast might readily disseminate and naturalize it. It is held to be one of the best plants for pickles, the young leaves being selected for that purpose.

Crocus sativus, L.—The Dye-Saffron. South Europe and Orient. The stigmata of this particular autumnal flowering crocus constitute the costly dye substance. The best is collected from the flowers, just as they daily open in succession. At our stage of colonization it would not be remunerative to grow saffron commercially; but as the plant is well adapted for our climate, it might be planted out into various unoccupied mountain localities, with a final view to naturalize it, and to render it thus available at a later period from native sources.

Crotalaria juncea, L. —The Sunn Hemp. Indigenous to South Asia, and also widely dispersed through tropi-

cal Australia. An annual herb, rising under favorable circumstances to a height of 10 feet. In our colony, Sunn can only be cultivated in the warmest and moistest localities. It comes in four or five months to maturity. The plant can also be grown as a fodder-herb for cattle. It requires rich, friable soil. If a superior soft fibre is desired, then the plant is pulled while in flower; if strength is the object, then the plant is left standing until it has almost ripened its seeds. The steeping process occupies about three days. For the purpose of obtaining branchless stems, it is sown closely.

Crotalaria retusa, L.—Asia, America, and Australia, within the tropics. A perennial herb. Its fibre resembles that of *C. juncea*, and is chiefly used for ropes and canvas. Others of the multitudinous species of *Crotalaria* deserve to be tested for their fibres.

Crozophora tinctoria, Necker.—South Europe, North Africa, and Orient. An annual herb. The turnsole-dye is prepared by exposure of the juice to the air, or by treating it with ammonia.

Cucumis cicatrisatus, Stocks.—Scinde, where it is called "Wungee." The edible ovate fruit is about 6 inches long.

Cucumis citrullus, Seringe. (*Citrullus vulgaris*, Schrader.)—Mediterranean regions. The Water-melon. It is simply mentioned here to indicate the desirability of naturalizing it in the interior deserts, where no cucurbita and only a single kind of edible cucumis (*C. acidus*, Jacquin), with fruits not larger than a pigeon's egg, is indigenous. In South African deserts it has become spontaneously established, and retains the characteristics of the cultivated fruit.

Cucumis colocynthis, L. (*Citrullus Colocynthis*, Schrader.)—From the Mediterranean regions to India. An annual herb. The medicinal extract of Colocynth is prepared from the small gourd of this species. Active principle: colocynthin.

Cucumis conomon, Thunberg.—Japan. An annual. The large fruit is used for preserves.

Cucumis melo, L.—The Melon. Originally from the country about the Caspian Sea. The best varieties might also be naturalized in our sand-deserts, particularly on places where some moisture collects. Some of the Bokhara varieties are remarkably luscious and large. Apparently remunerative results have been gained in Belgium from experiments to cultivate melons for sugar and treacle. The seeds, thus obtained in large quantities, become available for oil-pressing. The root contains melonemetin.

Cucumis momordica, Roxburgh.—Cultivated in India. It produces cucumbers 2 feet long, bursting slowly, when ripe, into several divisions. Young, the fruit is used like cucumbers; aged, like melons.

Cucumis sativus, L.—The Cucumber. Egypt. Indicated here merely for completeness' sake; also because gherkin pickling ought to become a more extended local industry.

Cucumis utilissimus, Roxburgh.—Mountains of Bengal. An annual, like the other species. Fruit of the size and shape of an ostrich's egg, with the flavor of melons. These fruits will keep for several months.

Cucurbita maxima, Duchesne.—Large Gourd. Turkey. Instances are on record of fruits having weighed over 2 cwt. Also this species is eligible for naturalization in the interior. Among other purposes, it serves for calabashes.

Cucurbita melopepo, L.—The Squash. May be regarded as a variety of *C. Pepo*. It will endure storage for months.

Cucurbita moschata, Duchesne.—The Musky Gourd. Doubtless, also, from the Orient.

Cucurbita Pepo, L.—The Pumpkin and Vegetable Marrow. Countries on the Caspian Sea. Its naturalization in the desert would be a boon. The seeds, on pressure, yield a fixed oil; they are also anthelmintic. *C. melanosperma*, A. Braun., is not edible.

Cuminum cyminum, L.—North Africa. The fruits of this annual herb are known as cumin, and used for certain condiments, as also in medicine. *Cuminum Hispanicum*, Merat, is similar. Essential oil peculiar.

Cycas revoluta, Thunberg.—The Japan Fern-palm. The trunk attains, in age, a height of about 6 feet, and is rich in sago-like starch. The slow growth of this plant renders it to us valuable for no other purpose than scenic decorative culture. *Cycas angulata*, R. Br., may also prove hardy, and would prove a noble horticultural acquisition, as it is the most gigantic of all Cycadeæ, attaining a height of 70 feet in tropical East Australia. Possibly, like the *Zamia* stems, also the trunks of *cycas* admit of translocation even at an advanced age.

Cynara cardunculus, L.—The Cardoon. Mediterranean regions. A perennial herb. The bleached leaf-stalks serve as esculents.

Cynara scolymus, L.—The Artichoke. South Europe and North Africa. The receptacles and the base of the flower scales well known as a vegetable. The plant is perennial, and here merely mentioned as entitled to extended culture in grouping this with other

stately plants. Several other species are worthy of cultivation.

Cynosurus cristatus, L. — The Crested Dogstail-Grass. Europe, North Africa, West Asia. A perennial grass, particularly valuable as withstanding drought, the roots penetrating to considerable depth. The stems can also be used for bonnet plaiting. Though inferior in value for hay, this grass is well adapted for permanent pasture, as it forms a dense turf without suffocating other grasses or fodder-herbs.

Cyperus corymbosus, Rottboell. — India. This stately perennial species may be chosen to fringe our lakes and ponds. It is extensively used for mats in India.

Cyperus papyrus, L. — The Nile Papyrus. Though no longer strictly a utilitarian plant, as in ancient times, it could scarcely be passed on this occasion, as it ought to become valuable in horticultural trade. Its grand aspect recommends it as very decorative for aquatic plantations.

Cyperus Syriacus, Parlatores. — The Syrian or Sicilian Papyrus. This is the papyrus-plant usual in garden cultivation. The plants in our Botanic Garden attain a height of 8 feet, but suffer somewhat from frost. Other tall Cyperi deserve introduction, for instance, *C. giganteus*, Rottboell, from West India and Guiana, these kinds of plants being hardier than others from the tropics. I have not ventured to recommend the introduction of *Cyperus esculentus*, L., a Mediterranean species, remarkable for its sweet tubers, known as earth almonds. It is stoloniferous, like the allied *Cyperus rotundus*, L., which has invaded the culture ground of many countries as an obnoxious, irrepressible weed. The tubers of *Cyperus esculentus* contain about 16 per cent. oil.

Cyperus vaginatus, R. Brown.—Widely dispersed over the Australian continent, but not yet noticed in Tasmania and New Zealand. It is restricted to swampy localities, and thus is not likely to stray into ordinary fields. It is our best indigenous fiber-plant, and it is likewise valuable as being with ease converted into pulp for good writing-paper, as shown by me some years ago. Its perennial growth allows of regular annual cutting. Within Victorian territory this galingale rush is particularly common on the Murray flats.

Cytisus scoparius, Link. (*Spartium scoparium*, L.) —The Broom-bush. Europe, North Asia. Of less significance as a broom plant than as one of medicinal value. It can also be used for tanning purposes. An alkaloid (spartein) and a yellow dye (scoparin) are obtainable from this Broom-bush.

Dactylis cæspitosa, Forster. (*Poa Fosteri*, Steudel.) —Fuegia, Falkland Islands, South Patagonia. The Tussock-grass. Thrives in cold countries near the sea, in pure sand, at the edge of peat-bogs. It would likely prosper in our alpine moors. It is perennial, and reaches to a height of 7 feet. It is very nutritious, and much sought by herds. The base of the stem is nutty and edible.

Dactylis glomerata, L. —Europe, North Africa, North and Middle Asia. The Cocksfoot-grass. One of the best of tall pasture grasses, adapted as well for dry as moist soil, thus even available for wet clays. It will live also under the shade of trees in forests. Its yield of fodder is rich and continuous, but its stems are hard. It is already largely cultivated, and has become naturalized.

Daucus Carota, L. — The Carrot. Europe, North Africa, extra-tropic Asia, east to Japan. Admits of naturalization along our shores. Beyond the ordinary culinary utilization it serves for the distillation of a peculiar oil. The chemical substances carotin and hydrocarotin are derived from it.

Digitalis purpurea, L. — Greater part of Europe. The Foxglove. A biennial, and exceedingly beautiful, of great medicinal value, easily raised. Chemical principles : digitalin, digitaletin, and three peculiar acids.

Dioscorea aculeata, L.* — The Kaawi-Yam. India, Cochin-China, South Sea Islands. Stem prickly, as the name implies, not angular. Leaves alternate, undivided. It ripens later than the following species, and requires no reeds for staking. It is propagated from small tubers. This yam is of a sweetish taste, and the late Dr. Seemann regarded it as one of the finest esculent roots of the globe. A variety of a blueish hue, cultivated in Central America (for instance, at Caracas), is of very delicious taste. In the warmest parts of our colony this and the following species are likely to come to perfection:

Dioscorea alata, L.* — The Uvi-Yam. India and South Sea Islands. The stems are four-angled and not prickly. The tubers, of which there are many varieties, will attain, under favorable circumstances, a length of 8 feet, and the prodigious weight of 100 pounds ! This species and the preceding one are the two principal kinds cultivated in tropical countries. *D. alata* is in culture supported by reeds. It is propagated from pieces of the old root, and comes to perfection, in warm climes, in about seven months. The

tubers may be baked or boiled. It is this species which has been successfully cultivated in New Zealand, and also in the Southern States of North America.

Dioscorea globosa, Roxburgh.—India. Roxburgh states this to be the most esteemed yam in Bengal.

Dioscorea hastifolia, Nees.—Extra-tropic Western Australia, at least as far south as 32°. It is evidently one of the hardiest of the yams, and on that account deserves particularly to be drawn into culture. The tubers are largely consumed by the aborigines for food. It is the only plant on which they bestow any kind of cultivation, crude as it is.

Dioscorea Japonica, Thunberg.* (D. Batatas, De-caisne.)—The hardy Chinese and Japan Yam. This species, which is not prickly, has been cultivated some years in our Botanic Garden. The material here for comparison is not complete, but seems to indicate that *D. transversa*, R. Br., and *D. punctata*, R. Br., are both referable to *D. Japonica*. If this assumption should prove correct, then we have this yam along the coast tracts of North and East Australia as far south as latitude 33°. In Australia we find the wild root of good taste.

Dioscorea nummularia, Lamarck.—The Tivoli Yam. Continental and Insular India, also South Sea Islands. A high-climbing, prickly species, with opposite leaves. Roots cylindrical, as thick as an arm; their taste exceedingly good.

Dioscorea oppositifolia, L.—India and China. Not prickly. One of the edible yams.

Dioscorea pentaphylla, L.—Continental and Insular India, also South Sea Islands. Likewise a good yam. A prickly species, with alternate divided leaves.

Dioscorea purpurea, Roxb. — India. In Bengal considered next best to *D. Alata*.

Dioscorea sativa, L. — South Asia, east as far as Japan, also in the South Sea Islands and North and tropical East Australia; likewise recorded from tropical Africa. Stem cylindrical, not prickly. The acrid root requires soaking before boiling. It has proved hardy in the Southern States of North America.

Dioscorea spicata, Roth. — India. Root used like those of other species.

Dioscorea tomentosa, Koenig. — Ooyala Yam. India. The nomenclature of some of the Asiatic species requires further revision.

Dioscorea trifida, L. fil. — Central America. One of the yams there cultivated. Various other tuberous *Dioscoreæ* occur in tropical countries; but their respective degrees of hardiness, taste, and yield are not recorded or ascertained. The length of the Victorian warm season is probably sufficient for ripening all these yams.

Diospyros Kaki, L. fil. — The Date-plum of China and Japan. A slow-growing, not very productive tree, here recorded for completeness. The fruit is yellow, or pink, or dark purple, variable in size, but never larger than an ordinary apple. It has ripened at Sydney. *D. Virginiana*, L., has been recorded among the timber-trees.

Dipsacus fullonum, L. — Fuller's Teazel. Middle and South Europe and Middle Asia. A tall, biennial herb. The thorny fruit-heads in use for fulling in cloth factories. The import during one of the last years into England was valued at £5,000. The plant is most easily raised. The use of these teazels has not yet been superseded by any adequate machinery.

Dolichos Lablab, L. — Warmer parts of Africa ; probably thence spread widely through the tropics. An annual herb, sometimes lasting through several years. The young pods, as well as the ripe seeds, available for culinary use, but not of all varieties. It delights in rich soil, and ripens in hot countries within three months ; its yield is about fortyfold, according to Roxburgh. The whole plant forms excellent stable-feed for cattle.

Dracocephalum Moldavica, L. — North and Middle Asia. An annual, showy, scent-herb.

Ecballion Elaterium, Richard.—Mediterranean regions and Orient. The Squinting Cucumber. An annual. The powerful purgative elaterium is prepared from the pulp of the fruit. Chemical principles ; elaterid, elaterin, hydroelaterin.

Ehrharta Diplax, F. v. Mueller. (*Microlæna avenacea*, J. Hooker.)—New Zealand. This tall, perennial grass is fond of woodlands, and deserves introduction. It is likely to prove a rich pasture-grass. A few other Australian species, particularly of the section *Tetrarrhena*, are readily accessible to us, and so, indeed, also the South African *Ehrhartas*, all adapted for our clime, the majority perennial, and several of superior value. *Ehrharta caudata*, Munro, is indigenous in Japan.

Ehrhartastipoides, Labillardiere.—Extra-tropic Australia ; also New Zealand. A perennial grass, which keeps beautifully green all through the year. For this reason its growth for pasturage should be encouraged, particularly as it will live on poor soil. Mr. W. H. Bacchus, of Bacchus-Marsh, considers it nearly as valuable as Kangaroo-grass, and, in the cool season, more so. He finds it to bear over-stocking better than

any other native grass, and to maintain a close turf. It is, however, not always copiously seeding.

Eleusine Coracana, Gærtner.—Southern Asia, east to Japan. Though annual, this grass is worthy of cultivation on account of its height and nutritiveness. The large grains can be used like millet.

Eleusine stricta, Roxburgh.—India. The increase of grain of this annual grass, in rich soil, is at times five-hundredfold. *E. tocusso*, Fresenius, is a valuable kind from Abyssinia, seemingly allied to *E. stricta*. The Arabian and Himalayan *E. flagellifera*, Nees, is perennial. Other species of eleusine are deserving of trial.

Elymus arenarius, L.*—The Sea Lyme-Grass. Europe and North Asia, on sand-coasts. One of the most important and vigorous of grasses for binding drift-sand on the sea-shores. The North American *E. mollis*, Trinius, is allied to this species.

Elymus condensatus, Presl.—The Bunch-grass of British Columbia and California. This is favorably known as adapted for sand-land.

Eryum lens, L. (*Lens esculenta*, Moench.)—Mediterranean regions, Orient. The Lentil. Annual, affording in its seeds a palatable and nutritious food.

Euclea myrtina, Burchell.—South Africa. Berry small, black, but edible. To us this plant would hardly be more than an ornamental bush.

Euclea undulata, Thunberg.—South Africa. Berry small, red, edible. Other shrubby species from the same portion of the globe yield also esculent fruits, which under superior culture may vastly improve.

Erythroxyton Coca, Lamarek.*—Peru. This shrub is famed for the extraordinarily stimulating property

of its leaves, which pass under the names of Spadic and Coca. They contain two alkaloids, cocain and hygrin, also a peculiar tannic acid. Whether any of the many other species of erythroxyton possess similar properties seems never yet to have been ascertained.

Eupatorium triplinerve, Vahl. (E. Ayapana, Ventenat.)—Central America. A perennial, somewhat shrubby herb, possibly hardy in the warmer parts of our colony. It is used as a medicinal plant, also as an alexipharmic. It contains eupatorin and much essential oil, peculiar to the plant.

Fagopyrum cymosum, Meissner. — The perennial Buckwheat or rather Beechwheat of the Indian and Chinese Highlands.

Fagopyrum emarginatum, Babington. — Chinese and Himalayan mountains, where it is cultivated for its seeds. Annual.

Fagopyrum esculentum, Moench.—Central Asia. The ordinary Buckwheat. This annual herb succeeds on the poorest soil. The crushed amylaceous seeds can be converted by boiling or baking into a palatable and wholesome food. As an agrarian plant it can, with advantage, be raised as a first crop on sandy heath-land, newly broken up, for green manure. The period required for the cyclus of its vegetation is extremely short. Thus it can be reared on our higher Alps.

Fagopyrum Tataricum, Moench.—Middle and North Asia. Yields for the higher mountain regions a still safer crop than the foregoing; otherwise the remarks offered in reference to *F. esculentum* apply also to *F. Tataricum*.

Fagopyrum triangulare, Meissner. — In the Himalayan Mountains, ascending naturally to regions 11,500 feet high. An annual. *F. rotundatum*, Babington, seems a variety of this species. It is cultivated for food like the rest.

Festuca elatior, L.*—The Meadow Fescue. Europe, North Africa, North and Middle Asia. A perennial grass, attaining a height of several feet. There are several varieties of this species. The tallest follows rivers readily as far down as the tides reach. The ordinary form is well adapted for permanent pastures, has tender leaves, produces excellent hay, and is early out in the season. It can be mixed advantageously with *F. ovina*. It is superior to rye-grass in produce and improves with age. *F. arundinacea*, Schreb., *F. pratensis*, Huds., and *F. loliacea*, Huds., are varieties of this species.

Festuca Hookeriana, F. v. Mueller.—Alps of Australia and Tasmania. A tall perennial grass, evidently nutritious, required to be tried for pastoral culture, and perhaps destined to become a meadow-grass of colder countries.

Festuca ovina, L.—Sheep-Fescue. Europe, North and Middle Asia, North America, found also in South America and the Alps of Australia and New Zealand. This species, like *F. elatior*, is obtainable with facility. *F. duriuscula*, L., and *F. rubra*, L., are varieties. A perennial grass, thriving on widely different soil, even moory and sandy ground. It yields a good produce, maintains its virtue, resists drought, and is also well adapted for lawns and the swards of parks.

[The space does not admit of entering here into further details of the respective value of many species of

festuca, which might advantageously be introduced from various parts of the globe for rural purposes.]

Ficus Carica, L.*—Orient. The ordinary Fig-tree. It attains an age of several hundred years. In our latitudes and clime a prolific tree. The most useful and at the same time the most hardy of about a thousand recorded species of *Ficus*. The extreme facility with which it can be propagated from cuttings, the resistance to heat, the comparatively early yield and easy culture, recommend the Fig-tree to be chosen where it is an object to raise masses of tree-vegetation in widely treeless landscapes of the warmer zones. Hence the extensive plantations of this tree made in formerly woodless parts of Egypt ; hence the likelihood of choosing the fig as one of the trees for extensive planting through favorable portions of our desert-wastes ; where, moreover, the fruit could be dried with particular ease. Caprification is unnecessary, even in some instances injurious and objectionable. Two main varieties may be distinguished, that which produces two crops a year and that which yields but one. The former includes the gray or purple fig, which is the best, the white fig and the golden fig, the latter being the finest in appearance but not in quality. The main variety, which bears only one crop a year, supplies the greatest quantity of figs for drying, among which the Marseillaise and Bellonne are considered the best. The Barnisote and the Aubique produce delicious large fruits, but they must be dried with fire-heat, and are usually consumed fresh. The ordinary drying is effected in the sun. For remarks on this and other points, concerning the fig, the valuable tract, recently published by the Rev. Dr. Bleas-

dale, should be consulted. The first crop of figs grows on wood of the preceding year; the last crop, however, on wood of the current year. Varieties of particular excellence are known from Genoa, Savoy, Malaga, Andalusia.

Flemingia tuberosa, Dalzell.—Western India. The tubers of this herb are said to be edible. Another species, *F. vestita*, is on record as cultivated in Northwestern India for its small esculent tubers.

Foeniculum officinale, Allioni.—The Fennel. Mediterranean regions, particularly on lime-stone soil. A perennial or biennial herb, of which two primary varieties occur—the so-called sweet variety having fruits almost twice as large as the other. The herb and fruits are in use as condiments, and the latter also for medicine. The fruits are rich in essential oil, containing much anethol.

Fourcroya Cubensis, Haworth. — West India and continental tropical America. A smaller species than the following, but equally utilized for fiber and impenetrable hedges. *F. flavo-viridis*, Hooker, from Mexico, is still smaller.

Fourcroya gigantea, Ventenat.—Central America. With species of *Yucca*, *Agave*, *Dracæna*, *Cordyline*, *Phormium*, *Doryanthes*, and this and a few other *Fourcroyas*, we have gigantic liliaceous plants available industrially for fiber. Frost injures the leaves of this species. Scape up to 30 feet high.

Fourcroya longæva, Karw. and Zucc. — High mountains of Guatemala and Mexico, at an elevation of about 10,000 feet. One of the most gigantic and magnificent of all liliaceous or amaryllideous plants, in volumen only surpassed by *Dracæna Draco*,

the Dragon-tree of the Canary Islands. This is the only known high-stemmed species, the trunk attaining a height of 50 feet and the huge panicle of flowers 40 feet more. It dies, like many allied plants, after flowering. The species is recorded here as a fibre plant, but with us would mainly or solely be kept for its ornamental grandeur.

Fragaria Chilensis, Aiton.—In various of the colder parts of North and South America. Chile Strawberry.

Fragaria collina, Ehrhart.—In various parts of Europe. Hill Strawberry.

Fragaria grandiflora, Ehrhart. (*F. Ananas*, Miller.)—Various colder parts of America. Closely allied to *F. Chilensis*. Ananas Strawberry.

Fragaria Illinoensis, Prince—North America. Hovey's Seedling and the Boston kind from this plant.

Fragaria pratensis, Duchesne. (*Fragaria elatior*, Ehrhart.)—In mountain forests of Europe. Cinnamon Strawberry. Hautbois.

Fragaria vesca, L.—Naturally very widely dispersed over the temperate and colder parts of the northern hemisphere. Wild-wood Strawberry. From this typical form probably some of the other strawberries arose. Middle forms and numerous varieties now in culture were produced by hybridization. These plants, though abounding already in our gardens, are mentioned here, because even the tenderest varieties could be naturalized in our ranges. Any settler living near some brook or rivulet might readily set out some plants, which, with others, similarly adapted, would gradually spread with the current.

Fragaria Virginiana, Miller, — North America, Scarlet Strawberry.

Gaultieria Shallon, Pursh.—North-western America. This handsome, spreading bush would yield its pleasant, edible berries in abundance if planted on our snowy mountains, where it would likely become naturalized.

Gaylussacia frondosa, Torrey and Gray.—The Blue Tangleberry of North America. A bush with deciduous foliage. Berry sweet.

Gaylussacia resinosa, Torrey and Gray.—The Black Huckleberry of North America. A dwarf shrub with deciduous leaves. It likes swampy woodlands, and thus would find ample space in our forest ranges. Berry of pleasant taste. Perhaps some of the South American species produce also edible fruits.

Geitonoplesium cymosum, All. Cunningham.—Through the whole East Australian forests. It is mentioned here to draw attention to the fact that special culture may convert this into an asparagus plant, as Mr. P. O'Shanesy has found that the young shoots offer a fair substitute for asparagus.

Genista monosperma, Lamarek.—Mediterranean regions. One of the best broom-bushes for arresting sand-drift. *G. sphaerocarpa*, Lam., is of like use, and comes also from the Mediterranean Sea.

Gentiana lutea, L.—Sub-Alpine tracts of Middle and South Europe. A perennial, most beautiful herb, yielding the medicinal gentian-root. It could be easily raised in our higher mountains. Chemical principles: gentian-bitter and gentianin.

Gladiolus edulis, Burchell.—Interior of South Africa. The bulb-like roots are edible, and taste like chestnuts, when roasted.

Glycine hispida, Bentham. (*Soja hispida*, Moench.)

—An annual herb of India, China, and Japan. The beans are one of the main ingredients of the condiment known as Soja. *Glycine Soja*, Siebold and Zuccarini, is said to be a distinct plant, but probably serving the same purpose.

Glycyrrhiza, echinata, L.—South Europe and Orient. From the root of this herb at least a portion of the Italian liquorice is prepared. The root is thicker than that of the following. The Russian liquorice-root is derived from this species. It is less sweet.

Glycyrrhiza glabra, L.—South Europe. The extract of the root of this herb constitutes the ordinary Liquorice. The plant grows here most vigorously. The liquorice is of some utility in medicine, but also used in porter breweries. Chemical principle: *Glycyrrhizin*.

Gossypium arboreum, L.*—The Tree Cotton. India, Arabia. A tall, perennial species, but not forming a real tree; yielding cotton in the first season. Leaves long-lobed. Bracts with few teeth. Petals yellow, or in age pink or purple. Seeds brown, disconnected; after the removal of the cotton-fiber, greenish-velvety. The cotton of long staple, but a variety occurs with short staple. The New Orleans cotton (*G. sanguineum*, Hassk.) belongs to this species. Dr. Seemann connects also the ordinary *G. herbaceum*, L., as a variety with *G. arboreum*. The cotton-fiber is crisp, white, opaque, and not easily separable.

Gossypium Barbadense, L.*—West India. Sea Island Cotton. Leaves long-lobed. Petals yellow. Seeds disconnected, black; after the removal of the cotton-fiber, naked. The cotton of this species is very long, easily separable, and of a silky lustre. This spe-

cies requires low-lying coast tracts for attaining to perfection. Perennial, and yielding, like the rest, a crop in the first season. Cultivated largely in the Southern States of North America, also in South Europe, North Africa, Queensland, and various other countries.

Gossypium herbaceum, L.*—Scinde, Cabul, and other parts of tropical and sub-tropical Asia; much cultivated in the Mediterranean countries. Perennial. Leaves short-lobed. Petals yellow. Seeds disconnected; after removal of the cotton-fiber, gray-velvety. Distinguished and illustrated by Parlatore as a species; regarded by Seemann as a variety of *G. arboreum*. Staple longer than in the latter kind, white, opaque, not easily seceding. Even this species, though supposed to be herbaceous, will attain a height of 12 feet. A variety with tawny fiber furnishes the Nankin cotton.

Gossypium hirsutum, L.*—Upland or Short-staple Cotton.—Tropical America; cultivated most extensively in the United States, Southern Europe, and many other countries. Perennial. Seeds brownish-green, disconnected; after the removal of the cotton-fiber, greenish-velvety. Staple long, white, almost of a silky lustre, not easily separable. A portion of the Queensland cotton is obtained from this species. It neither requires the coast tracts nor the highly-attentive culture of *G. Barbadense*.

Gossypium religiosum, L.* (*G. Peruvianum*, Cavan.)—Tropical South America. Kidney Cotton, Peruvian or Brazilian Cotton. Leaves long-lobed. Petals yellow. Seeds black, connected. The cotton is of a very long staple, white, somewhat silky and easily

seedling from the seeds. A tawny variety occurs. This is the tallest of all cotton-bushes, and it is probably this species which occurs in the valleys of the Andes as a small tree, bearing its cotton while frosts whiten the ground around.

Gossypium Taitense, Parlatores. (*G. religiosum*, Banks and Solander.)—In several islands of the Pacific Ocean. A shrub. Petals white. Seeds disconnected, glabrous after the removal of the fulvous cotton-fiber, which secedes not with readiness.

Gossypium tomentosum, Nuttall.* (*G. Sandvicense*, Parlat.; *G. religiosum*, A. Gray.)—Hawaii. Perennial. Petals yellow. Seeds disconnected, after the removal of the tawny cotton-fiber; fulvous-velvety, not easily parting with their cotton.

There are many parts of our colony in which all these species of *Gossypium* could be cultivated, and where a fair or even prolific cotton crop may be obtained. Good cotton, for instance, has been produced on the Goulbourn River, the Loddon, the Avoca, and the Murray rivers, particularly in places where water could be applied. All cultivated kinds of cotton-plants are either naturally perennials or become such in favorable climes, although they may be treated strictly as annuals. Some of them will, indeed, in particular instances, grow to the height of twenty feet. The geographic parallels between which cotton-culture is usually placed are stretching in various girdles between the thirty-six degrees north latitude and thirty-six degrees south latitude. The primary advantages of this important culture are: A return in a few months, comparatively easy field operations, simple and not laborious process of collecting the crop, and

requirement of but little care in the use of the gin-machine in finally preparing the raw material for the market, the woolly covering of the seeds constituting the cotton of commerce. The oil obtained by pressure from the seeds is useful for various technic purposes, and the oil-cake can be used like most substances of similar kind, for very fattening stable-feed. Sea Island Cotton was raised in splendid perfection in the northern parts of Victoria fully fifteen years ago, from seeds, extensively distributed by the writer; but the want of cheap labor has hitherto militated against the extensive cultivation of the cotton, and so also against the culture of tea and many other industrial plants. Cotton having been raised far away from the influence of the sea-air, it would be worthy of attempts to naturalize various kinds of cotton in the oases of our deserts, irrespective of regular culture. Our native *Gossypium* of the interior produces no fibre worth collecting. Cotton-plants have a predilection for gently-undulating or sloping ground, with light soil and a moderate supply of moisture. In the most favorable climes, such as that of Fiji, cotton produces flowers and fruits throughout the year, but the principal ripening falls in the dry season. From two hundred to three hundred plants or more can be placed on an acre. As many as seven hundred pods have been gathered from a single plant at one time, twelve to twenty capsules yielding an ounce of mercantile cotton. Weeding is rendered less onerous by the vigorous growth of the plants. Cotton comes well in for rotation of crops. Major Clarke has ascertained that crossing cannot be effected between the Oriental and Occidental kinds of cotton. A high

Summer temperature is needed for a prolific cotton harvest. Intense heat, under which even maize will suffer, does not injuriously affect cotton, provided the atmosphere is not dry in the extreme. The soil should not be wet, but of a kind that naturally absorbs and retains humidity, without over-saturation. In arid regions it is necessary to irrigate the cotton plant. Heavy rains at the ripening period are injurious, if not destructive to the cotton crop. Dry years produce the best returns, yet aqueous vapor in the air is necessary for the best yield. In colder localities the bolls or capsules continue to ripen after the frosts prevent the formation of new ones. Porous soils, resting on limestones and metamorphic rocks, are eminently adapted for cotton culture. The canebrake soil of the North American cotton regions absorbs ammonia to a prodigious extent.

Guadua angustifolia, Kunth. (*Bambusa Guadua*, Humboldt and Bonpland.)—New Granada, Ecuador, and probably others of the Central American States. This Bamboo attains a height of 40 feet, and might prove hardy in sheltered places of our lowlands.

Guadua latifolia, Kunth. (*Bambusa latifolia*, Humb. and Bonpl.)—One of the tall Bamboos of Central America, from whence several other lofty bamboos may be obtained, among them the almost climbing *Chusqueas*. This *Guadua* is stouter than any Indian Bamboo. In tropical America native bamboos are planted for hedges.

Guizotia oleifera, Candolle. — India and probably also Abyssinia. The Ramtil oil is pressed from the seeds of this annual herb, which yields its crop in three months. The oil is much used, like *Sesamum* oil, as well for culinary as technic purposes.

Hedeoma pulegioides, Persoon.—The Pennyroyal of North America. An annual herb of aromatic taste, employed in medicine.

Hedysarum coronarium, L.*—The Soola Clover. South Europe. One of the best of perennial fodder-herbs. It carries with it also the recommendation of being extremely handsome.

Helianthus annuus, L.*—The Sunflower. Peru. This tall, showy and large-flowered annual is not without industrial importance. As much as 50 bushels of seeds or rather seed-like nutlets have been obtained from an acre under very favorable circumstances, and as much as 50 gallons of oil can be pressed from such a crop. The latter can be used not only for machinery, but even as one of the best for the table. Otherwise the seeds afford an excellent fodder for fowl. The stalks furnish a good textile fibre, and the blossoms yield a brilliant, lasting, yellow dye. About 6 lbs. of seeds are required for an acre. The plant likes calcareous soil. Several allied North American species deserve perhaps rural culture. The return from a sunflower field is attained within a few months.

Helianthus tuberosus, L.—Brazil. Sunflower Artichoke. Inappropriately passing under the name Jerusalem Artichoke. The tubers are saccharine and serve culinary purposes. The stem is rich in textile fibre. The percentage of crystalline sugar is largest during the cold season—namely, five to six one hundredths. During the Summer the starch-like Inulin prevails. This plant can only be brought to full perfection in a soil rich in potash.

Heliotropium Peruvianum, L.—Andes of South America. A perennial, somewhat shrubby plant.

Among various species of *Heliotrope* this one can best be utilized for the distillation of the scented oil.

Helleborus niger, L.—Forest mountains of Middle and South Europe. The Christmas Rose of British gardens. A perennial, handsome herb. The roots are used in medicine.

Hibiscus cannabinus, L. (*H. radiatus*, Cavanill.)—Tropical Asia, Africa and Australia. An annual, showy herb. The stem yields a hemp-like fibre; the leaves serve as sorrel-spinach. Several other hibisci can be utilized in the same manner.

Hibiscus esculentus, L.—West India and Central America. A tall herb. The mucilaginous seed-capsules are known as Okra, Bandakai, or Gumbo, and used as culinary vegetables. Our Summers bring them to maturity. The leaves of this and allied species can be used as pot-herbs.

Hierochloa redolens, R. Br. —South-eastern Australia, almost confined to the Alps; in Tasmania and New Zealand also found in the lowlands, occurring likewise in the antarctic islands and the southern extremity of America. A tall perennial nutritious grass, with the odor of *Anthoxanthum*. It is worthy of dissemination on moist pasture land. *H. borealis* of the colder regions of the northern hemisphere accompanies here in the south *H. redolens*, but is a smaller grass.

Hordeum deficiens, Steudel.—The Red Sea Barley. One of the two-rowed barleys, cultivated in Arabia and Abyssinia. Allied to this is *H. macrolepis*, A. Br., a native of Abyssinia.

Hordeum distichon, L.—Central Asia. The ordinary two-rowed barley. To this species belong the

ordinary English Barley, the Chevalier, the Annat, the Dunlop, the long-eared, the black, the Italian and the Golden Barley, along with other kinds. A variety with grains free from the sepals constitutes the Siberian and the Haliday barley, which, however, is less adapted for malt. Dry barley-flour, heated at the temperature of boiling water during several hours, constitutes Hufeland's meal for invalids. Barley-culture might be carried on in many parts of our Alps.

Hordeum hexastichon, L.—Orient. The regularly six-rowed Barley. This includes, among other varieties, the Scotch, the Square, and the Bear Barley. Seeds less uniform in size than those of *H. distichon*. The so-called skinless variety is that in which the grain separates from the calyx.

Hordeum secalinum, Schreber. (*H. pratense*, Hudson.)—Europe, North and Middle Asia, North America. Perennial. Famed as the best fattening grass of many of the somewhat brackish marsh pastures on the North Sea. It never fruits when kept down by cattle, and suppresses finally nearly all other grasses and weeds.

Hordeum vulgare, L.—Orient. The four-rowed Barley, though rather six-rowed, with two prominent rows. Several varieties occur, among them the Spring, Winter, and Black Barley, the Russian, the French, the Naked, and the Wheat Barley. Chemical principles of malt: Asparagin; a protein substance: diastase; an acid, and cholesterin fat.

Hordeum zeocriton, L.—Central Asia. Also a two-rowed Barley. To this species belong the Sprat, the Battledore, the Fulham, and the Putney Barley.

Hovenia dulcis, Thunberg.—Himalaya, China, Ja-

pan. The pulpy fruit-stalks of this tree are edible. *H. inæqualis*, D. C., and *H. acerba*, Lindl., are mere varieties of this species.

Humulus lupulus, L.*—The Hop-plant. Temperate zone of Europe, Asia, and North America. This twining, perennial, unisexual plant has proved to yield enormously on river-banks, in rich soil, or on fertile slopes, where irrigation could be effected, particularly so within our territory, along the river-valleys of Gipps Land, and in other similar localities. A pervious, especially alluvial soil, fertile through manure or otherwise, appliances for irrigation, natural or artificial, and also shelter against storms, are some of the conditions for success in hop-growth, and under such conditions the rearing of hops will prove thus far profitable in countries and localities of very different mean temperature. A dry Summer season is favorable to the ripening and gathering of hops. On the Mitchell River, in Gipps Land, 1,500 pounds have been obtained from an acre. In Tasmania large crops have been realized for very many years. The plant might be readily naturalized on river-banks and in forest valleys. The scaly fruit-cones form the commercial hops, whose value largely depends on the minute glandular granules of Lupuline. Hops impart their flavor to beer, and, principally by their tannic acid, prevent acetous fermentation and precipitate albuminous substances from the malt. Hop-pillows are recommended to overcome want of sleep. Many of the substitutes of hops are objectionable or deleterious. The refuse hops of breweries possess double the value of stable manure. Active principles of hop-leaves and fruits: A peculiar volatile and a bitter acid substance.

The fibre of the stem can be made into cords and paper.

Hydrastis Canadensis, L. — North America. The Yellow Pocomoon. A perennial herb, utilized in medicine. The root contains two alkaloids : Berberin and hydrastin.

Hyoscyamus niger, L. — The Henbane. Europe, North Africa, extra-tropic Asia. An important medicinal herb of one or two years' duration. It contains a peculiar alkaloid : Hyoscyamin.

Hyphæne Argun, Martius. — Nubia. Probably hardy in the warmer parts of our colony.

Hyphæne coriacea, Gaertner. — Equatorial Eastern Africa. The dichotomous Palm of the sea-coast regions. It attains a height of 80 feet.

Hyphæne crinita, Gaertner. (H. Thebaica, Martius.) — Abyssinia, Nubia, Arabia, and Egypt, as far as 31° north, and southward to the Zambesi, Nyassa, and Sofala. The Gingerbread-palm or Doum-palm. It is much branched and attains a height of about 30 feet. The mealy husk of the fruit is edible. Grows away from the sea.

Hyphæne ventricosa, Kirk. — Zambesi. Loftier than the other species. Stem turgid toward the middle. Fruit large.

Hypochoëris apargioides, Hook and Arn. — Chile. A perennial herb. The root is used for culinary purposes, like that of the *Scorzonera Hispanica*.

Hypochoëris Scorzonerae, F. v. M. (*Achyrophorus Scorzonerae*, Cand.) — Chile. Of the same use as *H. apargioides*. Allied species of probably similar utility exist in Western South America.

Ilex Paraguensis, St. Hilaire. — Uruguay, Paraguay,

and Southern Brazil. The Mate. This Holly-bush is inserted into this list rather as a stimulating medicinal plant than as a substitute for the ordinary Tea-plant. Chemical principles : Coffein, Quina-acid, and a peculiar tannic acid, which latter can be converted into viridin-acid.

Illicium anisatum, L. — China and Japan. The Star-Anis. An evergreen shrub or small tree. The starry fruits used in medicine and as a condiment. Their flavor rests on a peculiar volatile oil with Anethol. This species and a few others deserve culture also as ornamental bushes.

Indigofera Anil, L. — Recorded as indigenous to West India, and as extending naturally through Continental America from Carolina to Brazil. A shrub several feet high. Pods sickle-shaped, short, compressed. One of the principal Indigo plants under cultivation both in the eastern and western hemispheres. Only in the warmest parts of our colony can we hope to produce indigo with remunerative success. But many of the hardier species seem never yet tested for pigment. Already 114 are recorded alone from extra-tropical Southern Africa. An *Indigofera* of Georgia, said to be wild, perhaps *I. Anil*, yields an excellent product. The pigment, in all instances, is obtained by maceration of the foliage, æration of the liquid and inspissation of the sediment.

Indigofera argentea, L. (*I. coerulea*, Roxb.) — Tropical and extra-tropical Northern Africa, Arabia, India. A shrub several feet high, closely allied to *I. Anil*, and likewise a good indigo-plant.

Indigofera tinctoria, L. — Warmest part of Asia, as far east as Japan, recorded also from tropical Africa

and even Natal. A shrubby plant, attaining a height of 6 feet. Pods straight, cylindrical, many-seeded. Extensively cultivated in warm zones for indigo, and probably hardy in our northern and eastern lowland regions.

Inula Helenium, L. — The Elecampane. Middle and South Europe, Middle Asia, eastward to Japan. A perennial herb. The bitter and somewhat aromatic root, for the sake of its stimulating and tonic properties, is used in medicine. It contains also the amyloseous Inulin and the crystalline Helenin.

Ipomœa Batatas, Poiret.* (*Batatas edulis*, Choisy.) — The Sweet Potato. Tropical South America. First brought to Europe from Brazil. It proved well adapted also for our part of Australia and for New Zealand. The tubers afford a palatable food, more nutritious than ordinary potatoes. Varieties with red, white, and yellow roots occur. Each tuber weighs generally from 3 to 5 pounds, but may occasionally attain to 56 pounds. The yield is from 200 to 300 bushels from an acre.

Ipomœa paniculata, R. Brown. — Almost a cosmopolitan plant on tropical coasts; thus indigenous to North Australia and the warmer parts of East Australia. The tubers also of this species are edible. If hardy, the plant would deserve cultivation.

Ipomœa purga, Wenderoth. — Mountains of Mexico. The true Jalap. This species yields the medicinal Jalap root. It has recently been cultivated with apparent success even at New York. Thus it is entitled to a trial in our warm woodlands. Active principle: the resinous convolvulin.

Ipomœa simulaus, Hanbury. — Mexico. From this

species the Tampico Jalap, or rather the Cerro Gordo Jalap, is derived. *I. operculata*, Mart., yields the Brazilian Jalap.

Isatis indigotica, Fortune.—North China. Perennial, almost shrubby. The use is similar to that of the following plant:

Isatis tinctoria, L.—Dyer's Wood. From the Mediterranean regions through part of the Orient, apparently extending as far as Japan. A tall herb of two years' duration. The blue dye is obtained from the fermented leaves. Many other species of *Isatis*, mostly Asiatic, may produce perhaps dye with equal advantage. Boissier enumerates merely as Oriental 28 kinds.

Jasminum grandiflorum, L.—From India to Japan. Flowers white. Extensively cultivated in South Europe. The delicate scent is withdrawn either by fixed oils or alcoholic distillation. The pecuniary yield obtainable from jasmin cultivation seems vastly overrated, even if inexpensive labor should be obtainable.

Jasminum odoratissimum, L.—Madeira. Shrubby like the rest. Flowers yellow. Used like the foregoing and following for scent. This may be prepared by spreading upon wool or cotton, slightly saturated with olive-oil or other fixed oil, the flowers, and covering them with other layers so prepared. The flowers are renewed from time to time, until the oil is thoroughly pervaded by the scent, when the latter is withdrawn by alcohol. Other modes of extracting the oil exist.

Jasminum officinale, L. — From the Caucasus to China. Flowers white. This is the principal species cultivated in South Europe for its scent.

Jasminum Sambac, Aiton.—From India to Japan. It would probably endure our cool season in the northern and eastern regions. It has the richest perfume of all. The bush attains a height of 20 feet, and is almost climbing. The flowers are white, and must be collected in the evening before expansion. The relative value of many other species of jasmin, nearly all from the warmest parts of Asia, seems in no instance to have been ascertained, as far as their oils or scents are concerned. Our Australian species are also deliciously fragrant; among which *J. lineare*, Br., occurs in our Victorian deserts; while also *J. didymum*, Forst.; *J. racemosum*, F. v. M.; *J. simplicifolium*, Forst.; *J. calcareum*, F. v. M., and *J. suavissimum*, Lindl., reach extra-tropic latitudes.

Jubæa spectabilis, Humboldt.—The tall and stout Coquito Palm of Chile. Well adapted for our extra-tropical latitudes. A kind of treacle is obtained from the sap of this palm. The small kernels are edible.

Justicia Adhatoda, L.—India; enduring the climate of the lowlands of Victoria. This bush possesses anti-spasmodic and febrifugal properties. It can be utilized also as a hedge-plant.

Kentia Baueri, Seemann.—The Norfolk Island Palm. Height 40 feet.

Kentia Belmoriana, M. and M.—The Curly Palm of Lord Howe's Island. About 40 feet high. With its congeners, evidently destined to grace our gardens, and to become also important for horticultural traffic abroad.

Kentia Centerburyana, M. and M.—Umbrella Palm of Lord Howe's Island. Likewise a tall and hardy palm.

Kentia Mooreana, F. v. M.—Dwarf Palm of Lord Howe's Island, where it occurs only on the summits of the mountains.

Kentia sapida, Blume.—The Nika Palm of New Zealand and the Chatham Islands. It also attains a height of 40 feet, and is one of the hardiest of all palms. The unexpanded flower-spikes can be converted, as palm-cabbage, into food.

Lactuca virosa, L. — Middle and South Europe, North Africa, Middle Asia. A biennial. The inspissated juice of this Lettuce forms the sedative *Lactucarium*.

Lathyrus pratensis, L. — Europe, North and Middle Asia. The Meadow Pea. A good perennial pasture-herb.

Lathyrus sativus, L. — Middle and South Europe. The Jarosse. An annual forage-herb; the pods also available for culinary purposes. Probably other species of *Lathyrus* could advantageously be introduced.

Lavandula angustifolia, Ehrhart. (*L. vera*, Candolle.) — Countries around and near the Mediterranean Sea. The Lavender-plant, of somewhat shrubby growth, from which, by distillation, the best oil of lavender is prepared. It lives on dry soil, but is less hardy than the following.

Lavandula latifolia, Villars. (*L. spica*, Candolle.) — South Europe, North Africa. Also from this species much lavender-oil is obtained.

Lavandula Stœchas, L. — South Europe, North Africa. This shrub can also be utilized for oil-distillation and other purposes, for which the two other lavenders are used. The quality of the oil of these species seems to differ according to their locality of growth.

Lawsonia alba, Lamarek.—North and Middle Africa, Persia, Arabia, India, and North-western Australia. The Henne or Henna-bush. It may become of use as a dye-plant in parts of our colony free of frost. The orange pigment is obtained from the grinded foliage.

Lavatera arborea, L.—Tree-Mallow of Middle Europe and the countries about the Mediterranean Sea. A tall, biennial plant of rapid growth. The ribbon-like bast is produced in greater abundance than in most other malvaceous plants. The Tree-Mallow might easily be naturalized on our shores. Perhaps it might serve with allied plants for green manure.

Leersia oryzoides, Swartz.—Middle and South Europe, various parts of Asia, Africa, and America. A perennial nutritious swamp-grass. Other *Leersias* from both hemispheres are deserving of introduction.

Lepidium sativum, L.—The Cress. Orient. Annual. Irrespective of its culinary value, Cress is of use as one of the remedies in cases of scurvy. Active principle: A volatile oil and the bitter Lepidin.

Lepidosperma gladiatum, La Billard.—The Sword-Sedge of the sea-coasts of extra-tropic Australia. One of the most important plants for binding sea-sand; also yielding a paper material as good as Sparta.

Leptospermum lævigatum, F. v. M. (*Fabricia lævigata*, Gaertner.)—The “Sandstay.” Sea-shores and sand-deserts of extra-tropic Australia, but not extending to Western Australia. This shrub or small tree is the most effectual of all for arresting the progress of drift-sand in a clime like ours. It is most easily raised by simply scattering, in Autumn, the seeds on the sand and covering them loosely with boughs.

Ligustrum Japonicum, Thunberg. — The Japan Privet. A shrub, evergreen, or nearly so, promising to become a valuable hedge-plant. It grows, like the ordinary European Privet, readily from cuttings.

Linum usitatissimum, L.* — The Flax plant. Oriental. A well-known annual, which yields the fiber for linen and the linseed oil. Flax-culture is doubtless destined to become an important industry among us. Few plants find a wider congeniality of soil and climate, and few give a quicker return. Good and deep soil, well drained, is requisite for successful flax-culture. Change of seed-grain is desirable. Thick sowing extends the length of the fiber. To obtain the best fiber, the plant must be pulled when the seeds commence to ripen. If the seeds are allowed in part to mature, then both fiber and seed may be turned to account. If the seed is left to ripen completely, then the fiber is generally discarded. The seed yields by pressure about 22 per cent. of oil. The residue can either be prepared as linseed-meal, or be utilized as admixture to stable-fodder. The demand for both fiber and oil is enormous. The value of our imports of raw fiber, in 1871, was already £15,634, while the import of oil was £22,469. The principal varieties are under culture: a tall sort, with smaller flowers, closed capsules and dark seeds; a dwarf sort, more branched (even if closely sown), with larger flowers and capsules, the seed-vessels opening spontaneously and with elasticity, while the seeds are of a pale color. None of the perennial species of *Linum* are so manageable in culture as the ordinary annual flax.

Lippia citriodora, Kunth. — Peru, Chile, La Plata

States, Brazil. An evergreen shrub, yielding scented oil.

Lithospermum hirtum, Lehmann. — North American Alkanna. A showy, perennial herb; the root yields a red dye.

Lithospermum canescens, Lehmann. — North American Alkannet. This, as the vernacular name indicates, offers also a dye-root.

Lithospermum longiflorum, Sprengel. — North America. A red pigment can also be extracted from the root of this species.

Livistona Australis, Martius. — East Australia. Our own and only Palm-tree in Victoria, occurring in East Gipps Land (in the latitude of Melbourne), and there attaining a height of 80 feet. The young leaves can be plaited as a material for cabbage-tree hats.

Livistona Chinensis, R. Brown. — South China and Japan. A very decorative Fan-palm, hardy in our lowlands.

Lolium perenne, L.* — Europe, North Africa, Western Asia. The perennial Rye-Grass, mentioned here for completeness' sake. *L. Italicum*, Al. Br. (the Italian Rye-Grass), seems to be only a variety. One of the most important of all pasture-grasses, also almost universally chosen for lawn-culture. It produces an abundance of seeds, which are readily collected, and easily vegetate. It arrives early to perfection. Nevertheless the produce and nutritive powers are considerably less than those of *Dactylis glomerata*, *Alopecurus pratensis*, and *Festuca elatior*; but it pushes forward earlier than the last-mentioned grass, while the ripening of seeds is less defective than in *Alopecurus*. Rye-grass, though naturally living but a few

years, maintains its ground well by the ease with which it disseminates itself spontaneously. Several sorts, which scarcely can be called varieties, are under cultivation. Rye-grass stands the dry heat of our Summers well. It is likely to spread gradually over the whole of the Australian continent, and may play an important part in our pastoral affairs, and also in ameliorating the climate of the desert districts.

Lupinus albus, L.—The White Lupine. Countries at the Mediterranean Sea, also in the Orient. An annual quick-growing herb, valuable for fodder and for green manure. The lentil-like seeds, after the bitter principle (Lupinin) has become removed through boiling, become edible. It would lead too far to enumerate here many others of the numerous species of Lupines, of which unquestionably very many are eligible for agrarian purposes, while all are acceptable as hardy, elegant, and easily-grown garden plants. One (*L. perennis*, L.) extends in America to the Northern States of the Union, and Canada; fourteen are recorded from South Europe, seventeen from Brazil, and numerous species from other parts of America, where the limits of the genus are about Montevideo southward and about Nootka Sound northward. The majority of the species is perennial. The Egyptian *L. Ternis*, Forsk., is closely allied to *L. albus*, and of equal use.

Lupinus luteus, L.—The Scented Yellow Lupine. Countries in the vicinity of the Mediterranean Sea. This likewise annual species is predominantly in use through Middle Europe, to improve sandy soil. It can also be employed like some other Lupines as a fodder herb. About 90 pounds of seeds are required for an acre.

Lupinus varius, L. — The Blue Lupine. Also a Mediterranean annual, used like the above cogeners ; but a few others are undercultivation as Blue Lupines. Some of the American, particularly Californian species, are regarded for agrarian purposes superior to the Mediterranean kinds.

Maclura aurantiaca, Nuttall.—The Osage Orange, or North American Bow-wood, or Yellow-wood. Texas, Arkansas, Louisiana. This thorny deciduous shrub or tree can be well-trained into hedges. It is unisexual, and will in favorable localities on rich river banks attain a height of 60 feet, with a stem 2 to 3 feet thick, thus becoming available as a timber-tree. Here it is recorded as a hedge-plant ; as such our own thorny *Maclura Calcar Galli* (*Morus Calcar Galli*, A. Cunningh.), of extra-tropical East Australia, which moreover possesses small edible fruits, deserves attention for live fences. Neither of the two is readily subject to blight or attacks of insects. The latter produces suckers and from the root a yellow dye.

Maharanga Emodi, A. de Candolle.—Nepaul. The root produces, like that of *Alkanna tinctoria*, a red dye.

Mallotus Philippinensis, J. M. (*Rottlera tinctoria*, Roxburgh.)—South Asia and East Australia, in jungle-country, extending into New South Wales. Though not of great importance, this bush should not be passed on this occasion, inasmuch as the powdery substance investing the seed-capsules constitutes the Kamala, which can be employed not only as an orange dye, but also as an anthelmintic remedy. The Hindu silk-dyers use it for an orange color, obtained by boiling the Kamala with carbonate of soda.

Manihot Aipi, Pohl.—The Sweet Cassava. Tropical South America, but traced as far south as the Parana River. The root is reddish and harmless; it can therefore be used, unlike those of the following species, without any further preparations than boiling, as a culinary esculent, irrespective of its starch being also available for tapioca. Both are somewhat woody plants, several feet high, and they are too important to be left altogether unnoticed on this occasion, although we have no evidence that they will prove productive even in those parts of Victoria which are free of frost. The *Aipi* has ligneous, tough fibres, stretching along the axis of the tubers, while generally the roots of the following species are free of this central woody substance.

Manihot utilissima, Pohl.—The Bitter Cassava or Tapioca-plant. Tropical South America. Closely allied to the former, producing varieties with roots of poisonous acidity, and with tubers perfectly harmless. The tubers attain a length of 3 feet; they can be converted into bread or cakes, the volatile poison of the milky sap being destroyed through pressing of the grated root in first instance, and the remaining acidity is expelled by the heating process. The starch, heated in a moist state, furnishes the tapioca. *Manihot* is abundantly cultivated at Caracas, where the singularly uniform temperature, throughout the year, is only 60 degrees to 70 degrees F. It is a very exhausting crop, and stands thus in need of rich soil and manuring. The propagation is effected by cuttings from the ligneous part of the stem. The soil destined for Cassava must not be wet. In warm countries the tubers are available in about eight months,

though they still continue to grow afterward. The growth of the plant upward is checked by breaking off the buds. The Bitter Cassava is the more productive of the two. The yellowish tubers attain sometimes a weight of 30 lbs. They do not become soft by boiling, like Aipi.

Maoutia Puya, Weddell.—India, on mountains up to 4,000 feet. It is taller than *Bœhmeria nivea*, and furnishes a similar fibre. This shrub belongs to a tribe of the nettle order, not possessing burning acidity. None of the true nettles, such as the Girardinias, nor allied stinging plants, have been recommended in this index, although from some an exquisite fiber is derived, as the writer wishes to guard against the introduction of any burning species, which possibly might disseminate itself in a mischievous manner in our ranges, and then probably could not be suppressed.

Maranta arundinacea, L.—The true Arrowroot-plant. West India. The plant is introduced into this list not without hesitation, as it seems to require a warmer clime than ours to attain perfection. It furnishes most of the genuine West Indian Arrowroot, although other species, such as *M. nobilis*, *M. Allouya*, *M. ramosissima*, are also cultivated for a similar starch of their tubers.

Matricaria Camomilla, L. — The annual Camomile. Europe, North and Middle Asia. A highly useful herb in medicine. In many parts of the European continent it is much more extensively used than the ordinary perennial Camomile. The infusion of the flowers has rather a pleasant taste, without strong bitterness. The flowers serve as a tonic and especially as a sudorific, and possess a peculiar volatile

oil. *Marrubium vulgare*, L., is not prominently mentioned, as it is already rather copiously naturalized.

Medicago sativa, L.*—Orient; now spread through Middle and South Europe and Middle Asia. The purple Medick, Alfalfa, or Lucerne. A perennial fodder-herb of great importance, and already largely utilized in our colony, perhaps descended from the English *Medicago falcata*, which also deserves naturalization. Lucerne keeps here green and fresh in the hottest season of the year, even in dry and comparatively barren ground, but develops itself for field-culture with the greatest vigor on river-banks, particularly in soil rich in lime. Its deeply penetrating roots render the plant particularly fit for fixing fenced embankments or hindering the washing away of soil subject to occasional inundations.

Melilotus alba, Desrouss.—The Cabul or Bokhara Clover. Middle and Southern Europe, North Africa, Middle Asia. A biennial herb. On account of its fragrance it is of value for admixture with hay. It is also a good bee-plant. Flowers white. Odorous principle: Cumarin.

Melilotus officinalis, Desrouss.—Europe, and Middle Asia. Also biennial, or lasting through several years if prevented from flowering. Contains also Cumarin. An allied species is *M. macrorrhiza*, Pers. Both serve purposes similar to those for which *M. alba* is employed.

Melissa officinalis, L.—The Balm-herb. South Europe and Middle Asia. A perennial herb, valuable for its scent, which depends on a peculiar volatile oil. It is also valuable as a bee-plant.

Melocanna bambusoides, Trinius, (Beesha Rhee-

dei, Kunth.)—The berry-bearing Bamboo, from Chittagong and other mountainous parts of India. It is a thornless bamboo, growing on dry slopes of hills. Height up to 70 feet ; circumference toward base 1 foot ; growth beautifully erect.

Melocanna humilis, Roeper.—India. More slender than the preceding species, and attaining only a height of 20 feet.

Melocanna Travancorica. (Beesha Travancorica, Beddome.)—A new bamboo from Travancore, worthy of introduction.

Mentha piperita, L.* —The Peppermint. Middle Europe. This well-known perennial herb is important for its peculiar essential oil, which here, by culture, is produced in good quality. This distilled oil is in considerable demand, and would be best obtained from plants cultivated in the mountain regions, or naturalized along the forest rivulets. Eminent authorities refer the Peppermint, as a variety, to *Mentha aquatica*, L., the Watermint of Europe, North Africa, West and North Asia, from which the true Crisp Mint (*M. crispa*, L.) is again derived, as well as the Bergamot Mint (*M. citrata*, Ehrh.).

Mentha Pulegium, L.—The true Pennyroyal. Europe, Western Asia, North Africa. A perennial scent herb, yielding a peculiar ethereal oil. It likes moist soil.

Mentha rotundifolia, L. —Middle and South Europe, North Africa, Western Asia. Fond of wet places, which, by the culture of this and other mints, may be profitably utilized. In odor this mint approaches to Melissa. The French and Italian Crisp Mint is partly derived from this species. Closely allied to the fol.

lowing, and often regarded as a variety of *M. viridis*, L.

Mentha silvestris, L.—The Horse Mint. Europe, North Africa, temperate Asia. Perennial. One of the Crisp Mints is derived from this species.

Mentha viridis, L.—The Spear Mint. Middle and South Europe. Perennial. A particular sort of Crisp Mint (*M. crispata*, Schrad.) belongs to this species.

[Our native Mints, *M. Australis* and *M. gracilis*, *M. saturejoides*, R. Br., yield also oil of good flavor. *M. Australis* is far the largest and most abundant of these plants.]

Meyanthes trifoliata, L.—Inappropriately called the Bog-bean. Europe, North and Middle Asia, North America. In springy and spongy bogs. A perennial herb of great beauty, which could be naturalized with facility in our Alps. The root is starchy. The whole plant is pervaded with a bitter principle, largely derived from Menyanthin. The plant is used medicinally as a tonic and febrifuge.

Microseris Forsteri, J. Hooker.—The Native Scorzonera of extra-tropical Australia and New Zealand. A perennial herb deserving attention, as likely its roots would enlarge and improve through culture. On the summits of our snowy mountains the plant develops itself most luxuriantly. The aborigines use the root for food. The plant would prove hardy in Middle Europe.

Morus alba, L.*—The White Mulberry-tree. China. This tree, in several varieties, provides the food for the ordinary Chinese silk-insect (*Bombyx Mori*). Silk was produced in Italy already 600 years ago, and there

this branch of industry has flourished ever since. In China, silk was reeled since 4500 years. This may demonstrate the permanency of an industry which we wish to establish here extensively under a similar sky. "One pound of silk is worth its weight in silver, and this pound may be produced (so far as the food of the *Bombyx* is concerned) from 30 pounds of Mulberry-leaves, or from a single tree, which thus may be brought to yield annually the material for 16 yards of Gros de Naples." The White Mulberry-tree is of extremely easy growth from cuttings, also readily raised from well-matured seeds. It is usually unisexual, and attains finally a large size. It can be grown in climes where no longer Olives will thrive. Spots for Mulberry-culture must not be over-moist, when the leaves are to be utilized for the *Bombyx*. In 1870, according to the *British Trade Journal*, the produce of cocoons amounted, in Europe, to £16,588,000; In Asia to £28,112,000; in Africa to £44,000; in the South Sea Islands to £24,000; in America to \$20,000; thus giving a general total of £44,788,000. Superior varieties of Mulberry can be grafted with ease on ordinary stock. *M. Indica*, L., *M. macrophylla*, Morett., *M. multicaulis*, Perott., *M. Morettiana*, Jacq., *M. Chinensis*, Bertol., *M. latifolia*, Poir., *M. Italica*, Poir., *M. Japonica*, Nois., *M. Byzantina*, Sieb., *M. nervosa*, Del., *M. pumila*, Nois., *M. tortuosa*, Audib., as well as the Constantinople Mulberry, are merely forms of *M. alba*, to which probably also *M. Tatarica*, L., and *M. pabularia*, Jacquem., belong. The variety known as *M. Indica* produces black fruits. The planting of Mulberry-trees has recently assumed enormous dimensions in California, where, in 1870,

between seven and eight millions were planted. The process of rearing the silk-insect is simple, and involves no laborious exertions. The cocoons, after they have been properly steamed, dried, and pressed, find readily purchasers in Europe, the price ranging, according to quality, from 3s. to 6s. per pound. The eggs of the silkworm sell at a price from 16s. to £2 per ounce; and, in 1870, Japan had to provide two millions of ounces of silk-ova for Europe, where the worms had extensively fallen victims to disease. Instances have been recorded in California where 8 tons of leaves were gathered in the first year from Mulberry-trees of 1 acre, and 30 tons in the next year. As an example of the profit thus to be realized a Californian fact may be cited, according to which £700 were the clear gain from $3\frac{1}{2}$ acres, the working expenses having been £93. The Commissioner of Agriculture of the United States has estimated that, under ordinary circumstances, an acre should support from 700 to 1,000 Mulberry-trees, producing 5,000 pounds of leaves fit for food, when four years old. On this quantity of leaves can be reared 140,000 worms, from which ova at a net profit ranging from £80 to £240 per acre will be obtained by the work of one person. Mr. C. Brady, of Sydney, thinks the likely proceeds of silk-culture to be from £60 to £150 for the acre. The discrepancies in calculations of this kind are explained by differences in climate, soil, attention, and treatment.

The White Mulberry-tree has been very copiously distributed from the Melbourne Botanic Garden since many years. A very palatable fruit is obtained from a variety cultivated in Beloochistan and Affghanis-

tan. *Morus Tatarica*, L., resembles *M. alba*. Its juicy fruit is insipid and small. The leaves are not generally used for silkworms.

The results of Mr. Brady's experience on the varieties of the *Morus alba* are as follows: In the normal form the fruits are white, with a purplish tinge more or less deep; the bark is pale; the leaf is also of a pale hue, not very early, nor very tender, nor very abundant. It may be grown on moist ground as long as such is drained, or it will live even on poor, loose gravelly soil, bordering on running water. The Cevennes variety is a free grower—affords a large quantity of leaves, though of rather thick consistence; all varieties of the *Morus Bombyx* like these leave at all stages of their age. It is also called the rose-leaved variety. The silk which it yields is substantial in quantity, and also good in quality. It does best on rich, dry slopes. The bushy Indian variety has a fine leaf of beautiful green, which, though light in weight, is abundantly produced. It can be cut back to the stem three or four times a year. The leaves are flat, long, and pointed, possess a fine aroma, and are relished by every variety of the ordinary silk-insect, though not all thrive equally well on it. The silk derived from this variety is excellent, but not always so heavy in quantity as that produced from the rosy variety. It prefers rich, low-lying bottoms, is a greedy feeder, but may thus be made to cover an extraordinary breadth of alluvial or manured land in a marvellous short space of time. At Sydney, Mr. Brady can provide leaves from this Indian variety all through the year by the removal of cuttings, which will strike their root almost at any season. It

ripens also seeds readily, and should be kept at bush size. It requires naturally less space than the other kinds. A fourth variety comes from North China; it has heart-shaped, flat, thickish leaves, which form very good food for the silk worm. Mr. Brady, as well as Mr. Martelli, recommend very particularly the variety passing under the name *Morus multicaulis*, for the worms in their earliest stages. The former recommends the Cape variety also; the latter wishes also the variety called *Morus Morettiana*, to be used on account of its succulent, nutritious foliage, so well adapted for the insect while yet very young, and also on account of producing the largest amount of food within the shortest time. The Manila variety, known as *Morus multicaulis*, comes several weeks earlier into bearing than most other sorts, and should therefore be at hand for early-hatched worms.

Morus nigra, L.*—The Black Mulberry-tree. South Russia and Persia. Highly valuable for its pleasant, refreshing fruits. It is a tree of longevity, instances being on record of its having lived through several centuries. It is also very hardy. The leaves also of this species afford food for the ordinary silk-moth. The tree occurs usually unisexual. *M. atropurpurea*, Roxb., from Cochin-China, is an allied tree. The cylindrical fruit-spike attains a length of two inches.

[*Morus rubra* has been recorded already in the Appendix to our Acclimatization Society's Report for 1870-1871, among the timber-trees.]

Musa Cavendishii, Lambert. (*M. regia*, Rumph.; *M. Chinensis*, Sweet.)—The Chinese Banana. A comparatively dwarf species, the stem attaining only a height of about 5 or 6 feet. Its robust and dwarf

habit render it particularly fit for exposed localities, and this is one of the reasons why it is so extensively cultivated in the South Sea Islands. The yield of fruit is profuse (as much as 200 to 300 fruits in a spike), and the flavor excellent. This, as well as *M. sapientum* and *M. paradisiaca*, ripens till their fruits in Madeira and Florida.

Musa Ensete, Gmelin. — Bruce's Banana. From Sofala to Abyssinia, in mountain regions. This magnificent plant attains a height of 30 feet, the leaves occasionally reaching to the length of 20 feet, with a width of 3 feet, being perhaps the largest in the whole empire of plants, exceeding those of *Strelitzia* and *Ravenala*, and surpassing even in quadrat-measurement those of the grand water-plant *Victoria Regia*, while excelling in comparative circumference, also, the largest compound frond of *Angiopteris evecta*, or divided leaf of *Godwinia Gigas*, though the compound leaves of some palms are still larger. The inner part of the stem, and the young spike of the *Ensete*, can be boiled to serve as a table esculent, but the fruit is pulpless. This plant produces no suckers, and requires several years to come into flower and seed, when it dies off like the Sago-plant, the *Caryota*-palm, and others, which flower but once without reproduction from the root.

Musa Livingstoniana, Kirk. — Mountains of Sofala, Mozambique, and the Niger regions. Similar to *M. Ensete*; seeds much smaller. Possibly requiring no protection here in favorable places.

Musa paradisiaca, L. — The ordinary Plantain or Pisang. India. Among the most prolific of plants, requiring the least care in climes adapted for its

growth. Stem not spotted. Bracts purple inside. In this, as well as the foregoing and the following, new shoots are produced from the root, to replace annually the fruit-bearing stem. The fruit of this is chiefly prepared by some cooking process. Only a few varieties are distinguished, and they seem to have sprung from the wild state of *M. sapientum*. The writer did not wish to pass this and the allied plants unnoticed, as they will endure our clime in the warmest localities of the colony, where, under more careful attention, they are likely to mature with regularity their fruit. They require rich and humid soil. Plantain meal is prepared by simply reducing the dried pulp to powder. It is palatable, digestible, and nourishing.

Musa sapientum, L. — The ordinary Banana or Sweet Plantain. India. One of the most important plants, yielding nutritious, delicious fruits. The stem is spotted. Bracts green inside. The leaves, and particularly the stalks and the stems of this and other species of *Musa*, can be utilized for producing a fiber similar to Manila Hemp. The fruit of this is used chiefly unprepared; it is generally of a yellow color. Numerous varieties are distinguished. As much as a hundred weight of fruit is obtained from a plant annually in tropical climes. At Caracas, where the temperature is seldom much above or below 60 degrees F., the Plantain and Banana plants are very productive, being loaded with fruits 12 to 15 inches long, on mountains about 5,000 feet high. In our dry Murray regions the winter temperature seems too low for the successful development of these plants, except on sheltered spots.

Musa troglodytarum, L. (*M. uranoscopos*, Rumph.)

—India, and apparently indigenous also in the Fiji and other islands of the Pacific Ocean. The fruit-stalk of this species stands upright; the edible fruits are small, reddish, or orange-colored. The Chinese *M. coccinea*, Ait., a dwarf ornamental species, has also the fruit-spike straight.

Myrica Faya, Aiton.—Madeira, Azores and Canary Islands. A small tree. The drupaceous fruits are used for preserves. *M. sapida*, Wallich., an Indian mountainous species, has also edible fruits.

Myrtus Ugni, A. Gray.—The Chilean Guava. A hardy shrub, freely bearing its small but pleasantly-aromatic berries.

Nardostachys Jatamansi, Cand.—Mountains of Bengal and Nepaul. A perennial herb, famous already in ancient times as a medicinal plant. The root contains an ethereal oil and bitter principle. This drug is often also obtained from *N. grandiflora*, Cand.

Nelumbo lutea, Caspary.* (*Nelumbium luteum*, Willd.)—In North America, north of 44 degrees; also in Jamaica. This magnificent perennial water-plant carries with it the type of *Nelumbo nucifera*, but seems more hardy and thus better adapted for our latitudes, the Pythagorean Bean not descending in Australia, naturally, beyond the 23d degree, although also this species may perhaps live in the warmer parts of our colony. The tuberous roots of both species resemble the Sweet Potato, and are starchy; the seeds are of particularly pleasant taste. To us the plants would be of great value as ornamental aquatics. The leaves of *N. lutea* are from 1 to 2 feet in diameter. The flowers measure one half to one foot across. The capsular fruit contains from 20 to 40 nut-

like seeds. The plant in congenial spots displaces nearly all other water-vegetation by the vigor of its growth.

Nelumbo nucifera, Gaertner.* (*Nelumbium*, specimen, Willd.)—The Pythagorean Bean. Egypt; at Caspian and Aral Seas (46 degrees N.); Persia; through India, where in Cashmere it occurs at an elevation of 5,000 feet; China; Japan; Amur (46 degrees N.); tropical Australia as far south as 23 degrees. The occurrence of this grand plant at the Ima, at Pekin, and at Astrachan proves sufficiently that we can naturalize it in Victoria. The *Nelumbo* requires deep water with a muddy bottom. The large white or rosy flowers are very fragrant. The seeds retain their vitality for several years. According to the ancient Egyptian method, they are placed in balls of muddy clay and chaff, and then sunk into the water.

Nephelium Litchi, Cambess. — South China, Cochinchina and Philippine Islands. An evergreen tree, producing the Litchi-fruit. The pulpy arillus is of extremely pleasant taste, though not large.

Nephelium Longanum, Cambess. — India and Southern China. The Longan-fruit is obtained from this tree. It is smaller than that of the Litchi-tree.

Nicotiana multivalvis, Lindley.—The Native Tobacco of the Columbia River. An annual. This with the following species can be utilized for certain kinds of tobacco.

Nicotiana Persica, Lindley—The Shiraz Tobacco. Persia. Annual. This can be brought to perfection only in cool mountain regions. The mode of culture is somewhat different to that of the ordinary tobacco.

Moderate irrigation is favorable. The plants, when ripe, are cut off and stuck into the ground again until they become yellow. They are then heaped together for a few days in the drying-house. They are then packed in thin strata and placed in bags, for pressure and daily turning.

Nicotiana quadrivalvis, Pursh. —The Native Tobacco of the Missouri. An annual.

Nicotiana repanda, Willd.—Cuba, Mexico, Texas. Annual. It is utilized for some of the Havana tobaccos.

Nicotiana rustica, L.—Tropical America. Annual. Some sorts of Eastern India Tobacco, of Manila Tobacco, and of Turkey (for instance Latakia) tobacco are derived from this particular species.

Nicotiana Tabacum, L.*—The ordinary Tobacco-plant of Central America. Annual. Various districts with various soils produce very different sorts of tobacco, particularly as far as flavor is concerned; and, again, various climatic conditions will affect vastly the tobacco-plant in this respect. We can thus not hope to produce, for instance, Manila or Havana tobacco in our latitudes, but we can anticipate to produce good sorts of our own, more or less peculiar, or we may aspire to producing, in our rich and frostless forest valleys, a tobacco similar to that of Kentucky, Maryland, Connecticut, and Virginia, parts of Victoria resembling in climate very much these countries. Frost is detrimental to the tobacco-plant; not only particularly when young must it be guarded against it, but frost will also injure the ripe crop. Mr. Politz considers the scarcity of dew in some of our districts to militate against the production of the best kinds;

otherwise the yield as a rule is large, and the soil in many places well adapted for this culture. Leaves of large size are frequently obtained. The moister and warmer northern and eastern regions of our colony are likely to produce the best tobacco, if the final preparation of the leaf for the manufacturer is effected by experienced skill. The cruder kinds are obtained with ease, and so leaves for covering cigars. Virgin soil, with rich loam, is the best for tobacco-culture; and such soil should also contain a fair proportion of lime and potash, or should be enriched with a calcareous manure and ashes, or with well-decomposed stable-manure. The seedlings, two months or less old, are transplanted. When the plants are coming into flower the leading top-shoots are nipped off, and the young shoots must also be broken off. A few weeks afterward the leaves will turn to a greenish-yellow, which is a sign that the plants are fit to be cut, or that the ripe leaves can gradually be pulled. In the former case the stems are split; the drying is then effected in barns, by suspension from sticks across beams. The drying process occupies four or five weeks, and may need to be assisted by artificial heat. Stripped of the stalks, the leaf-blades are then tied into bundles, to undergo sweating, or a kind of slight fermentation. It does not answer to continue tobacco-culture beyond two years on the same soil, uninterruptedly. A prominent variety is *Nicotiana latissima*, Miller, or *N. macrophylla*, Lehm., yielding largely the Chinese, the Oronoco, and the Maryland tobacco. The dangerously-powerful nicotine, a volatile, acrid, alkaline, oily liquid, and nicotianin, a bitter, aromatic lamellar substance, are both derived from tobacco in all its parts, and are therapeutic agents.

Niemeyera prunifolia, F. v. Mueller. —The Australian Cainito. An evergreen tree, sparingly dispersed from the north of New South Wales through the coast forests of Queensland. The fruit is of plum-like appearance and edible. Culture is likely to improve its quality.

Ocimum Basilicum, L.—The Basil. Warmer parts of Asia and Africa. An annual herb, valuable for condiments and perfumery. Several varieties exist, differing considerably in their scent. A crystalline substance is also obtained from this and similar species. *O. canum*, Sims, is closely allied.

Ocimum gratissimum, L. —Recorded from India, the South Sea Islands and Brazil, as indigenous. Somewhat shrubby. This is also a scent-plant, like the following, and is one of the best of the genus. *O. viride*, Willd., from tropical Africa, seems a variety.

Ocimum suave, Willd. — East Africa. A shrubby species.

Ocimum sanctum, L.—Arabia, India, tropical Australia. A perennial herb. The odor of the variety occurring in North Australia reminds of Anis; the smell of the variety growing in East Australia resembles cloves. *O. tenuiflorum*, L., seems to be another variety. Probably other species, as well cis as trans-Atlantic, can be used like Basil.

Olea Europæa, L* —The Olive-tree. From South-western Asia; naturalized in the countries around the Mediterranean Sea. A tree not of great height, but of many centuries' duration, and of unabating fecundity. The well-known olive oil is obtained from the fruit. Certain varieties of the fruit, preserved in vinegar or salt liquid before perfectly ripe, are also

much used for the table. For this purpose the fruit is generally macerated previously in water containing potash and lime. The gum-resin of the olive-tree contains the crystalline Olivil. The oil of the drupaceous fruit is a most important product of countries with climates similar to that of Victoria. Its chemical constituents are : 30 per cent. crystalline Palmitin ; 70 per cent. Olein, through which olive-oil belongs to those kinds which are not drying. The wild variety of the olive-tree has usually short, blunt leaves and thorny branches. Long-continued droughts, so detrimental to most plants, will affect the olive but slightly. It thrives best on a free, loamy, calcareous soil, even should it be strong and sandy, but it dislikes stiff clay. Proximity to the sea is favorable to it, and hill-sides are more eligible for its culture than plains. The ground must be deeply trenched. Manuring with well-decayed substances is requisite annually, or every second or third year, according to circumstances. Irrigation will add to the productiveness of the plant. Mons. Riondet distinguishes three main varieties, of which he recommends two : 1. The Cayon, a small-sized tree, which comes into bearing already after three or four years, but it bears fully only every second year. Its oil is fine, with some aroma. 2. The Pendulier, a larger tree, with long, drooping branches, yielding an oil of first-rate quality. Mons. Reynaud ("Culture de l'Olivier") separates 12 varieties as cultivated in France, and recommends, among them : 1. The Courniau, or Courniale—also called Plante de Salon—bearing most prolifically a small fruit, and producing an excellent oil. 2. The Picholine, which, by pruning its top branches, is led to

spread over eight square yards or more. It is of weeping habit, yields a good oil in fair quantity, and resists well the attack of insects. 3. The Mouraou, or Mourette, a large tree, furnishing also oil of a very fine quality. Olive-trees require judicious pruning immediately after the fruit is gathered, when the sap is comparatively at rest. They may be multiplied from seeds, cuttings, layers, suckers, truncheons or estacas, and old stumps, the latter to be split. The germination of the seeds is promoted by soaking the nutlets in a solution of lime and wood-ash. The seedlings can be budded or grafted after a few years. Truncheons or estacas may be from one to many feet long, and from one inch to many inches thick; they are placed horizontally into the ground. Olive plantations at Grasse are worth from £200 to £250 per acre. For many details the tract on the "Culture of Olive and its Utilization," here recently issued by the Rev. Dr. Bleasdale, should be consulted, as it rests largely on its author's observations during a long stay in Portugal. The olive-oil imported last year into Victoria was valued at £15,538.

The following notes are derived from the important "Tratado del Cultivo del Olivo en España," by the Chev. Capt. Jose de Hidalgo-Tablada (second edit., Madrid, 1870). The Olive-tree will resist, for a short time, considerable frost (-15° C.), provided the thawing takes place under fogs or mild rain (or perhaps under a dense smoke). It requires for ripening its fruit about one third more annual warmth than the vine. The olive-zones of South Europe and North Africa are between the 18° and 44° N. L. An elevation of about 550 feet corresponds, in Spain, as far as

this culture is concerned, to one degree further north. Olives do not grow well on granitic soil. The fruit produced on limestone formations is of the best quality. Gypsum promotes the growth of the tree (which thus may perhaps prosper in parts of the Murray desert, underlaid with gypsum). An equable temperature serves best; the exposure to prevailing strong winds is to be avoided. The Winter temperature should not fall below -70° C. The quantity of oil in the fruit varies from 10 to 20 per cent.; sometimes it even exceeds the latter proportion. In the Provence, at an average, 24 lbs. of olive-oil are consumed by each individual of the population; in Southern Germany nearly 60 lbs.; in Andalusia about 30 lbs. For obtaining the largest quantity of oil the fruit must be completely ripe. Hand-picked olives give the purest oil. Knocking the fruit from the branches with sticks injures the tree and lessens the productiveness in the next year. About 30 olive-trees can be planted conveniently on an acre, for permanence; each tree, under ordinary circumstances, will produce fruits for 4 lbs. to 5 lbs. of oil annually. Spain alone produces about 250,000,000 lbs. of olive-oil a year.

SPANISH VARIETIES.

A.—Varieties of early maturation, for colder localities:

1. Var. *pomiformis*, Clem.—Manzanillo. (French: Ampoulleau.) Fruit above an inch in diameter, spherical, shining black. Putamen broad and truncate.

2. Var. *regalis*, Clem.—Sevillano. (French: Pruneau de Cantignac.) Fruit about an inch in diameter, ovate-spherical, blunt, blueish-black.

3. Var. *Bellotudo*, or *Villotuda*.—Fruit about an inch long, egg-shaped; pericarp, outside dark-red, inside violet.

4. Var. *Redondillo*.—Fruit ovate-spherical, nearly an inch long. Pericarp, outside blueish-black, inside whitish. A rich yielder.

5. Var. *ovalis*, Clem.—Lechin, Picholin, Acquillo. (French: *Saurine*.) Fruit broad-oval, two thirds of an inch long. A copious yielder.

6. Var. *argentata*, Clem.—Nevadillo blanco; Doncel; Zorzalena; Moradillo; Oji-blanco; Olivo lucio. Fruit broad-ovate, an inch long, very blunt, not oblique. Quality and quantity of oil excellent.

7. Var. *Varal blanco*.—(French: *Blanquette*.) Fruit ovate, globular, three fourths of an inch long, neither pointed nor oblique; outside blackish-red.

8. Var. *Empeltre*.—Fruit ovate, an inch long, equable. Rich in oil of excellent quality; also one of the best for pickles. Pericarp, outside violet, inside white.

9. Var. *Racimal*.—(French: *Bouteillan*, *Boutiniere*, *Ribien*, *Rapugette*.) Fruit violet-colored, globose-ovate, about an inch long; neither pointed nor oblique. Bears regularly, also, on less fertile soil, and is one of the earliest to ripen.

10. Var. *Varal negro*.—Alameno. (French: *Cayon*, *Nasies*.) Fruit violet-black, spotted, globose-ovate, nearly an inch long, somewhat pointed. Bears very richly.

11. Var. *Colchonudo*.—Fruit spheric, outside red, inside white, one inch in diameter, slightly pointed. Produces a large quantity of good oil.

12. Var. *Ojillo de Liebre*.—*Ojo de Liebre*. Fruit

nearly spheric, outside violet - black ; about one inch long, somewhat oblique. One of the less early varieties.

13. Var. Carrasquena.—(French: Redouan de Cognitoat.) Fruit black-red, almost spherical, slightly oblique, about an inch long. Valuable both for oil and preserves, but liable to be attacked by various insects.

14. Var. Hispalensis, Clem.—Gordal; Ocal; Olivo real. Fruit black-gray, oblique, spherical, measuring fully an inch. Rather a large and quick-growing tree. Fruit used in the green state for preserves, not used for table-oil.

15. Var. Verdejo. — Verdial. (French: Verdal, Verdán.) Fruit black-violet, oblique-spheric, pointed, about one inch long. Furnishes good oil and resists best of all the cold.

B.—Varieties of late maturation, for warmer localities:

16. Var. maxima, Clem.—Madrileno ; Oivo morcal. Fruit over an inch long, cordate-globose, strongly pointed. Less valuable for oil than for preserves.

17. Var. rostrata, Clem. — Cornicabra. (French: Cournaud, Corniaud, Courgnale, Pl. de Solon, Pl. de la Fane ; Cayon, Rapunier, Grasse.) Strong and tall, less tender. Fruit black-reddish, over an inch long, oval, much pointed. Good for oil.

18. Var. ceratocarpa, Clem.—Cornezuelo. (French: Odorant, Luquoise, Luques.) Fruit fully an inch long, oval, pointed.

19. Var. Javaluno.—Fruit black-gray, over an inch long, egg-shaped, somewhat oblique, gradually pointed. Rich in good oil; can also be chosen for preserves; much subject to attacks of insects.

20. Var. *Picudo*.—*Fetudilla*. Fruit fully an inch long, egg-shaped, blunt at the base, pointed at the apex, with black-grey pulp. Pericarp easily separable. Employed both for oil and preserves.

21. Var. *Nevadillo negro*.—Fruit egg-shaped, fully an inch long, with turned pointed apex. One of the richest of all varieties in yield. Endures considerable cold and ripens not quite late.

All these Spanish varieties show rather long lanceolate leaves, of more or less width.

FRENCH VARIETIES.

(Some verging into the Spanish kinds.)

22. Var. *angulosa*, Gouan.—*Galliningue*, Laurine. For preserves.

23. Var. *Rouget*.—*Marvailletto*. Produces a fine oil.

24. Var. *atrorubens*, Gouan.—*Salierne*, *Saverne*. Fruit dusted white. Furnishes one of the best of oils.

25. Var. *variegata*, Gouan.—*Marbee*, *Pigale*, *Pigau*. Purple fruit with white spots.

26. Var. *Le Palma*.—Oil very sweet, but not largely produced.

27. Var. *atrovirens*, Ros.—*Pointue*, *Punchuda*. Fruit large, with good oil.

28. Var. *rubicans*, Ros.—*Rougette*. Putamen small. Yield annual and large.

29. Var. *alba*, Ros.—*Olive blanche*, *Blancane*, *Vierge*. This, with many others omitted on this occasion, is an inferior variety.

30. Var. *Caillet Rouge*.—*Figancier*. Small tree. Fruit large, red. Oil good, and produced in quantity.

31. Var. Caillet Blanche. — Fruit almost white ; produced annually and copiously, yielding a rather superior oil.

32. Var. Raymet. — Fruit large, reddish. Oil copious and fine. This variety prefers flat country.

33. Var. Cotignac. Pardigniere. Fruit middle-sized, blunt. Oil obtained in quantity, and of excellent quality. This wants much pruning.

34. Var. Bermillaon. — Vermillion. Yields also table-oil, and resists cold well.

Many other apparently - desirable varieties occur, among which the *Italian Oliva d'ogni mese* may be mentioned, which ripens fruit several times in the year, and furnishes a pleasant oil, and also berries for preserves.

Onobrychis sativa, La Marek.* — The Sanfoin or Cocks-head plant. South and Middle Europe, Middle Asia. A deep-rooting, perennial, fodder-herb, fond of marly soil, and living in dry localities. It is thus well-adapted, also, for the limestone formation of the lower Murray River.

Ophelia Chirata, Grisebach. (*Agathotes Chirata*, D. Don.) — Widely dispersed over the higher mountain regions of India. A perennial herb, considered as one of the best of tonics ; it possesses also febrifugal and antarthritic properties. Its administration in the form of an infusion, prepared with cold water, is the best. Besides *O. elegans*, Wight., some of the other Upper Indian, Chinese, and Japanese species deserve probably equal attention.

Opuntia coccinellifera, Miller. — Mexico and West Indies. The Cochineal Cactus. On this and *O. Tuna*, *O. Hernándezii*, and perhaps a few others, subsist the

coccus, which offers the costly cochineal dye. Three gatherings can be effected in the year. About 1,200 tons used to be imported annually into Britain alone, and a good deal also to other countries, valued at £400 for the ton. The precious carmin-pigment is prepared from cochineal.

Opuntia elatior, Miller. — Central America. A hedge-plant with formidable thorns.

Opuntia Ficus Indica, Miller. — Central America, north as far as Florida. Serves for hedges. Pulp of fruit edible.

Opuntia Hernandezii, Candolle. — Mexico. Affords also food for the *Coccus Cacti*.

Opuntia spinosissima, Miller. — Mexico and West India. Stem columnar, with pendant branches. Also a good hedge-plant.

Opuntia Tuna, Miller. — West India, Ecuador, New Granada, Mexico. Irrespective of its value as the principal cochineal plant, this cactus is also of use for hedges. It will attain a height of 20 feet. The pulp of the fruit is edible. With the other species hardy, at least, in our lowlands.

Opuntia vulgaris, Miller. — Central America, northward to Georgia, southward to Peru. Adapted for hedges, and, like the rest, inflammable, thus particularly valuable along railway-lines. The fruit almost smooth, also eatable. A dye can also be prepared from its pulp, and that of allied species. Numerous other species are here industrially eligible for hedging purposes.

Origanum Dictamnus, L. — Candia. Like the following, a scent-herb of somewhat shrubby growth.

Origanum Majorana, L. — North Africa, Middle

Asia, Arabia. A perennial herb, used for condiment, also for the distillation of its essential oil.

Origanum Maru, L. — Palestine. Perennial, and very odorous.

Origanum Onites, L.—Countries of the Mediterranean Sea. Somewhat shrubby and strongly scented.

Origanum vulgare, L.—The ordinary Marjoram. All Europe, North Africa, North and Middle Asia. A scented herb of perennial growth, containing a peculiar volatile oil. It prefers limestone soil. *O. hirtum*, Link., *O. virens*, Hoffmannsegg, and *O. normale*, D. Don, are closely allied plants of similar use. Several other Marjorams, chiefly Mediterranean, are of value.

Ornithopus sativus, Brotero. — South Europe and North Africa. An annual herb, larger than the ordinary Birdsfoot-clover. It is valuable as a fodder-plant on sterile soil.

Oryza sativa, L.*—The Rice-plant. South Asia and North Australia. Annual, like most cereals. The many rivulets in our ranges afford ample opportunities for irrigating rice-fields; but these can be formed with full advantage only in the warmer parts of the colony, where rice will ripen as well as in Italy, China, or the Southern States of the American Union. Among the numerous varieties of Indian Rice may be noted as prominent sorts: The Early Rice, which ripens in four months and is not injured by saline inundations. The hardier Mountain Rice, which can be raised on comparatively dry ground, and which actually perishes under lengthened inundation, but which is less productive. The Glutinous Rice, which succeeds as well in wet as almost dry places, and pro-

duces black or reddish grains. In the rich plains of Lombardy, irrigated from the Alps, the average crop is estimated at 48 bushels for the acre annually. The spirit distilled from rice and molasses is known as Arrack.

Oryza latifolia, Humb. and Bonpl.—Central America. This species is said to be perennial and to attain a height of 18 feet. It deserves here trial-culture, and may prove a good fodder-grass on wet land in warm localities. *O. perennis*, Moench., seems closely allied.

Oxalis crassicaulis, Zuccar.—Peru. This seems one of the best of those wood-sorrels which yield a tuberous, edible root. Among others, *O. tuberosa*, Mol., and *O. succulenta*, Barn., from Chile, as well as *O. carnosa*, Mol., and *O. conorrhiza*, Jacq., from Paraguay, might be tried for their tubers.

Pachyrrhizus angulatus, Rich. — From Central America—rendered spontaneous in many tropical countries. A climber, the horizontal starchy roots of which attain a length of 8 feet and a thickness of many inches. It requires rich soil. The root is edible, though inferior to Yam. From the stems a tough fiber is obtained. The plant proved hardy at Sydney.

Paliurus ramosissimus, Poir. (*P. Aubletia*, Schult.)—China and Japan. A thorny tree, which could be utilized for hedging.

Paliurus Spina Christi, Mill. (*P. aculeatus*, Lam.)—The Christ Thorn. From the Mediterranean Sea to Nepaul. A deciduous bush or finally tree, which can be trimmed into hedges.

Panicum amarum, Elliot. — North America. A

perennial species, fit to be grown on drifting coast-sand.

Panicum barbinode, Trinius. Brazil. Valuable as a fodder-grass.

Panicum ciliare, Retzius.—From South Europe and Southern Asia, spread through all countries with a warm climate, but apparently also indigenous in East Australia. It readily disseminates itself on barren ground, and is likely to add to the value of our desert pastures, although it is an annual. Stock relish this grass. *P. sanguinale*, L., and *P. glabrum*, Gaudin, are allied species.

Panicum Crus-Galli, L. — The Barn-yard Grass. Occurring now in all warm countries, but probably of Oriental origin, as it seems not recorded in ancient classic literature. A rich but annual grass of ready spontaneous dispersion. *P. colonum*, L., and *P. Crus-Corvi*, L., are varieties of it. Regarded by R. Brown as indigenous to Eastern and Northern Australia, where many other excellent fodder-species occur, some perennial. It will succeed also on somewhat saline soil, particularly on brackish water-courses.

Panicum decompositum, R. Brown. (*P. lævinode*, Lindl.)—The Australian Millet. One of the most spacious of native nutritious grasses. The aborigines convert the small millet-like grains into cakes. This grass will thrive on poor soil.

Panicum frumentaceum, Roxb.—The Shamalo or Deccan Grass. Probably introduced from tropical Africa into South Asia. It serves as a fodder-grass and produces also a kind of millet.

To this species is allied *P. sarmentosum*, Roxb.,

from Sumatra, which is now likewise much cultivated in tropical countries. It is perennial.

Panicum Italicum, L.—This grass, notwithstanding its specific name, is of Indian origin, but appears to be likewise a native of North Australia. It is annual and worthy to be cultivated as a tender green-fodder, attaining a height of five feet. The grain is not only one of the best for poultry, but that of some varieties can also be utilized as millet. *P. Germanicum*, Roth., is a form of this species.

Panicum Koenigii, Spreng. (*P. Helopus*, Trin.)—India. A good fodder-grass.

Panicum maximum, Jacq.* (*P. jumentorum*, Pers.)—The Guinea-grass. Tropical Africa; elsewhere not indigenous. This perennial grass attains the height of 8 feet in tropical countries. It is highly nutritious and quite adapted for the warmer parts of our colonial territory.

Panicum miliaceum, L.* (*P. milare*, Lam.)—The true Millet. South Asia and North Australia, but cultivated in Southern Europe already at Hippocrates' and Theophrastos' time. Annual, attaining a height of four feet. Several varieties occur, one with black grains. They all need a rich but friable soil. It is one of the best of all grains for poultry, but furnishes also a palatable, nutritious table-food. It ripens still in Middle Europe.

Panicum Pilosum, Swartz.—Tropical America. A perennial fodder-grass.

Panicum repens, L. — At the Mediterranean Sea, also in South Asia and North Australia. Regarded by the Cingalese as a good fodder-grass. It is pe-

rennial and well suited for naturalization on moist soil, or river-banks or swamps.

Panicum prostratum, Lam. (*P. setigerum*, Retz.)—Egypt, South Asia, North Australia, perhaps, also, indigenous to tropical America. Perennial. Recommendable for pastures.

Panicum spectabile, Nees.*—The Coapim of Angola. From West Africa transferred to many other tropical countries. A rather succulent, very fattening grass, attaining a height of about four feet. It may be assumed that hitherto about 300 well-defined species of *Panicum* are known, chiefly tropical and sub-tropical, thus very few extending naturally to Europe, or the United States of North America, or Japan, or the southern part of Australia. Though mostly from the hot zones, these grasses endure, in many instances, our clime, and some of them would prove great acquisitions—particularly the perennial species. Numerous good kinds occur in Queensland and North Australia spontaneously. *Panicum* is the genus richest in species among grasses.

Papaver somniferum, L.* — The Opium - Poppy. Orient. The capsules of this tall annual, so showy for its flowers, are used for medicinal purposes ; from the minute but exceedingly numerous seeds, oil of a harmless and most palatable kind can be pressed remuneratively; but a still more important use of the plant is that for the preparation of opium, of which a quantity valued in the Custom's returns at £94,455 was imported during 1871 into Victoria, and this does not provide for a large portion of morphia used in medicine. Both the black and pale-seeded varieties can

be used for the production of opium. The return of Poppy-culture, whether for opium or for oil, is within a few months. Our milder and somewhat humid open forest tracts proved most productive for obtaining opium from this plant; but it can be reared also in colder localities, good opium, rich in morphia, having even been obtained in Middle Europe and the northern United States, the Summers there being sufficiently long to ripen the poppy with a well-elaborated sap. The morphia contents in opium from Gipps Land was at an average somewhat over 10 per cent. Opium was prepared in our Botanic Garden for the Exhibition of 1866; but particularly Mr. J. Bosisto and Mr. J. Hood have given to this branch of rural industry here commercial dimensions. The Smyrna variety is particularly desirable for opium; it enables the cultivator to get from 40 pounds to 75 pounds of opium from an acre, generally worth 30s. to 35s. per pound. The ground for poppy-culture must be naturally rich, or otherwise be well-manured; dressing with ashes increases the fecundity of the plant. The seed, about 9 pounds to an acre, is generally sown broadcast, mixed with sand. In the most favorable places, as many as three crops are obtained during a season. The collecting of the opium, which consists merely of the indurating sap of the seed-vessels, is commenced a few days after the lapse of the petals. Superficial, horizontal, or diagonal incisions are made into the capsules as they successively advance to maturity. This operation is best performed in the afternoons and evenings, and requires no laborious toil. The milky opium-sap thus directed outward is scraped off next morning into a shallow cup, and allowed to

dry on a place away from sunlight ; it may also be placed on poppy-leaves. From one to six successive incisions are made to exhaust the sap, according to season, weather, locality, or the knife-like instrument employed. In the Department of Somme (France), alone, opium to the value of £70,000 annually is produced, and poppy-seed to the value of £170,000. Our seasons here, as a rule, are favorable for collecting opium, and thus this culture is here rendered less precarious than in many other countries. Our opium has proved as good as the best Smyrna kinds. The petals are dried for packing the opium. The main value of opium depends on its contents of morphia, for which the genus *Papaver*, as far as was hitherto known, remains the sole source. But not less than eleven alkaloids have been revealed in opium by the progressive strides of organic chemistry: Codein, Metamorphin, Morphia or Morphine, Narcein, Narcotin, Opianin, Papaverin, Porphyroxin, Pseudo-morphin and Thebain. It contains, beside, an indifferent bitter principle: Meconin and Meconic Acid (vide "Wittstein's Chemische Analyze von Pflanzentheilen.") Various species of *Papaver* produce more or less opium and morphia.

Parinarium Nonda, F. v. Mueller.—The Nonda-tree of North-east Australia. It may prove hardy in East Gipps Land, and may live, perhaps, in the dry and hot air of our deserts, where it deserves trial-culture for the sake of its edible, mealy, plum-like fruit. A few other species with esculent drupes occur in different tropical countries.

Parkinsonia aculeata, L.—From California to Montevideo. A thorny shrub, clearly adapted for the warm-

er parts of Victoria, where it might be utilized with the following plant for evergreen-hedges. The flowers are handsome.

Parkinsonia Africana, Sonder.—South Africa. A tall bush. A third species, *P. macrophylla*, Torr., occurs on the Colorado.

Paspalum distichum, Burm.—From India to South-eastern Australia. A creeping swamp-grass, forming extensive cushions. It keeps beautifully green throughout the year, affords a sufficiently-tender blade for feed, and is exquisitely adapted to cover silt or bare slopes on banks of ponds or rivers.

Paspalum serobiculatum, L.—Through the tropics of the eastern hemisphere widely dispersed, extending to South-east Australia. A valuable pasture-grass. A superior variety is cultivated in India for a grain crop. This grass furnishes a good quality of hay. The stem sometimes attains a height of 8 feet.

Passiflora alata, Aiton.—Peru and Brazil. This Passion-flower and all the following (and probably other species) furnish Granadilla fruits.

Passiflora coccinea, Aublet.—From Guiana to Brazil.

Passiflora cœrulea, L.—South Brazil and Uruguay. One of the hardiest of all Passion-flowers, and with many others well adapted for covering bowers, rockeries and similar structures. Many of the equatorial species come from mountainous regions and may thus endure our lowland clime.

Passiflora edulis, Sims.—Southern Brazil.

Passiflora filamentosa, Willd.—Southern Brazil.

Passiflora incarnata, L.—North America from Virginia and Kentucky southward. The fruits are called Maypops.

Passiflora laurifolia, L. (*P. tinifolia*, Jussieu.)—The Water-Lemon. From West India to Brazil.

Passiflora ligularis, Juss.—From Mexico to Bolivia.

Passiflora lutea, L.—North America from Pennsylvania and Illinois southward. Berries small.

Passiflora maliformis, L.—From West India to Brazil.

Passiflora quadrangularis, L.—Brazil. One of the most commonly cultivated Granadillas.

Passiflora serrata, L.—From West India to Brazil.

Passiflora suberosa, L. (*P. pallida*, L.)—From Florida to Brazil. A careful investigator, Dr. Maxw. Masters, has recently defined about 200 species of Passion-flowers.

Peireskia aculeata, Miller.—West India. The Barbadoes Gooseberry. A tall shrub, adapted for hedges in localities free of frost. The cochineal insect can be reared also on this plant. The berries are edible. Several other species exist in tropical America, among which *P. Bleo*, Humb., is particularly handsome, but they may not all be sufficiently hardy for utilitarian purposes in our clime. Otherwise the *Bleo* is used for salad.

Peireskia portulacifolia, Haw.—West India. This attains the size of a fair tree.

Pennisetum thyphoideum, Rich.* (*Penicillaria spicata*, Willd. *Panicum cceruleum*, Miller.)—Tropical Asia, Nubia and Egypt. The Bajree. An annual, ripening its millet crop in about three months in warm countries. The stems are thick and reach a height of 6 feet. This grass requires a rich and loose soil, and on such it will yield upward of a hundred-fold. It furnishes also a good hay, and is also valua-

ble as green-fodder. Some of the many other species of *Pennisetum* are doubtless of pastoral value. A plant allied to *P. thyphoideum* occurs in China: namely *P. cereale*, Trin. This affords, also, millet or corn for cakes.

Pentzia virgata, Lessing.—South Africa. A small bush, recommended to be established in our deserts for sheep-fodder. Several other species occur in South Africa.

Perilla arguta, Benth.—Japan. An annual herb. An infusion of this plant is used to impart to table-vegetables and other substances a deep red color. *P. ocimoides*, L., of Upper India, serves, probably, similar purposes.

Persea gratissima, Gærtner.—From Mexico to Peru and Brazil, in forest-tracts near the coast. The Avocado Pear. Suggestively mentioned here as likely available for East Gipps Land, French Island, and other mild localities of our country, inasmuch as it has become naturalized in Maderia, the Azores, and Canary Islands. A noble, evergreen, spreading tree. The pulp of the large, pear-shaped fruit is of delicious taste and flavor. *Persea Teneriffie* (*P. Indica*, Spreng.), indigenous to Maderia, the Canary Islands, and Azores, is a tree with hard and remarkably beautiful wood.

Peucedanum graveolens, Benth. (*Anethum graveolens*, L.)—The Dill. South Europe, North Africa, Orient. Annual. The well-known aromatic fruitlets used as a condiment. *P. Sowa*, Benth. (*Anethum Sowa*, Roxb.), is a closely-allied, Indian, annual herb.

Peucedanum officinale, L.—The Sulphur-root. Middle and South Europe, North Africa, Middle Asia.

Perennial. The root used in veterinary medicine. It contains, like that of the following species, the crystalline peucedanin.

Peucedanum Ostruthium, Koch. (*Imperatoria Ostruthium*, L.)—Mountains of Middle Europe. A perennial herb, which could be grown in our Alps. The acrid aromatic root is used in medicine, particularly in veterinary practice. It is required for the preparation of some kinds of Swiss cheese. *P. Cervaria*, Guss., and *P. Oreoselinum*, Moench., are also occasionally drawn into medicinal use.

Peucedanum sativum, Benth. (*Pastinaca sativa*, L.) The Parsnip. Europe, North and Middle Asia. Biennial. The root palatable and nutritious.

Phalaris Canariensis, L.—The Canary Grass. An annual grass from the Canary Islands, now widely dispersed as a spontaneous plant over the the warmer zones of the globe. Thus it has also become naturalized in Australia. It is grown for its seeds, which form one of the best kinds of feed for many sorts of small cage-birds. The flour is utilized in certain processes of cotton manufacture, and liked for some kinds of cakes. The soil for the culture of the Canary grass must be friable and not too poor. It is an exhaustive crop. As allied, annual species of similar use, but mostly of less yield, may be enumerated: *P. brachystachys*, Link., from Italy; *P. minor*, Retz, and *P. truncata*, Guss., from various countries at the Mediterranean Sea. Other species, including some from Asia, are deserving of trial; but the perennial British *P. arundinacea*, L., is too harsh to serve for wholesome fodder, nor does it furnish Canary seed.

Phaseolus adenanthus, G. Meyer. (*P. Truxillensis*,

sis, Humb.; *P. rostratus*, Wallich.)—Almost cosmopolitan within the tropics, where, irrespective of navigation and other traffic, it becomes dispersed by migrating birds; truly spontaneous also in tropical Australia. A perennial herb with large flowers, resembling those of *Vigna vexillata*, Benth. Cultivated for its seeds, which are rather small, but copiously produced.

Phaseolus coccineus, Kniphof.* (*P. multiflorus*, Willd.)—The Turkish Bean, or Scarlet-runner. A native of the Orient, if Sprengel's identification is correct, according to which this plant was known in Arabia and Persia, at Avicenna's time; but, according to other opinions, it is a native of Mexico. A twining, showy perennial, as useful as the ordinary French Bean. Its seeds usually larger than those of the latter plant—purple, with black dots, but sometimes also pure blue, and again quite white. The flowers occur sometimes white. The root contains a narcotic poison.

Phaseolus lunatus, L. — Considered as a native of tropical America, but also recorded as wild from many parts of tropical Africa and Asia. Biennial according to Roxburgh. Much cultivated in the warm zone for its edible beans, which are purple or white. A yellow-flowered variety, or closely-allied species, is known as the Madagascar Bean, and proved hardy and productive here. *P. perennis*, Walt., from the United States of North America, is another allied plant.

Phaseolus Mungo, L. (*P. Max*, L.)—The Green Gram. South Asia and tropical Australia. An annual, very hairy plant, not much climbing. Frequently reared in India when rice fails, or where that

crop cannot be produced. The seeds are but small, and the herb is not available for fodder. This plant requires no irrigation, and ripens in two and a half to three months. The grain tastes well, and is esteemed wholesome. The harvest is about thirtyfold.

Phaseolus vulgaris, L.* — The ordinary Kidney Bean, or French Bean, or Haricot. India, from whence it came to Europe, through the conquest of Alexander the Great; but apparently it is also wild in North-western Australia. Though this common and important culinary annual is so well known, it has been deemed desirable to refer to it here with a view of reminding that the Kidney Bean is nearly twice as nutritive as wheat. The meal from beans might also find far augmented use. As constituents of the beans should be mentioned a large proportion of starch (nearly half); then much Legumin; also some Phaseolin (which, like Amygdalin, can be converted into an essential oil), and Inosit-Sugar. Lentils contain more Legumin, but less starch, while peas and beans are, in respect to the proportion of these two nourishing substances, almost alike. *Phaseolus nanus*, L., the Dwarf Bean, and *P. tumidus*, Savi, the Sugar Bean, or Sword Bean, or Egg Bean, are varieties of *P. vulgaris*. Several other species of *Phaseolus* seem worthy of culinary culture.

Phleum pratense, L.* — The Cat's-tail, or Timothy Grass. Europe, North Africa, North and Middle Asia. One of the most valuable of all perennial fodder-grasses. Its production of early spring-herbage is superior to that of the Cock's-foot grass. It should enter largely into any mixture of grasses for permanent pasturage. It will live also on moist and cold

clay-ground. This grass, and perhaps more yet the allied *Phleum alpinum*, L., are deserving of an extensive transfer to our moory Alps. For hay, it requires mowing in a young stage. The seed is copiously yielded and well retained.

Phoenix dactylifera, L.*—The Date-palm. North Africa, also inland; Arabia, Persia. This noble palm attains finally a height of 80 feet. It is unisexual, and of longevity. "Trees of from 100 to 200 years old continue to produce their annual crop of dates." Though from the sap sugar or palm-wine can be obtained, and from the leaves hats, mats, and similar articles can be manufactured, we here would utilize this palm, beyond scenic garden ornamentation, only for its fruits. It is in the oases of our desert-tracts, swept by burning winds, where the Date-palm would afford, in time to come, a real boon, although it might be grown also in the valleys of our mountains and in any part of our lowlands. Several bunches of flowers are formed in a season, each producing often as many as 200 dates. Many varieties of dates exist, differing in shape, size, and color of the fruit; those of Gomera are large and contain no seed. The unexpanded flower-bunches can be used for palm-cabbage; the fiber of the leaf-stalks for cordage. The town Elche, in Spain, is surrounded by a planted forest of about 80,000 Date-palms, and the sale of leaves for decorative purposes produces, irrespective of the value of the date-fruits, a considerable income to the town; and so it is at Alicante. As far north as the Gulf of Genoa exists also a date-forest. The ease with which this palm grows from seeds affords facility, in adapted climes, to imitate these examples, and we certainly ought to follow them in all parts of Australia.

Phœnix paludosa, Roxb.—India. A stout species, not very tall. Of value, at least, for decorative culture.

Phœnix pusilla, Gærtner.—India and South China. A dwarf species, likely also to be hardy here. *P. farinifera*, Roxb., appears to be identical. It is adapted for sandy and otherwise dry and barren land, but prefers the vicinity of the sea. Berry shining black, with a sweet, mealy pulp.

Phœnix reclinata, Jacquin.—South Africa, in the eastern districts. A hardy species, but not tall, often reclining. It is adapted for ornamentation. The seeds are frequently drawn into local use as a substitute for coffee.

Phœnix silvestris, Roxb.—India, almost on any soil or in any situation. It has proved at Melbourne a very hardy species. Its greatest height is 40 feet. Berries yellowish or reddish, larger than in *P. pusilla*. Where this palm abounds much sugar is obtained from it by evaporation of the sap, which flows from incisions into the upper part of the trunk, a process not sacrificing the plant, as for 20 years the sap can thus be withdrawn. A kind of Arrack is obtained by fermentation and distillation of this sap. Each plant furnishes the juice for about 8 lbs. of date-sugar annually, but in some instances much more. About 50,000 tons of sugar are produced a year in Bengal alone from this and some other palms.

Phœnix spinosa, Thonning.—Tropical Africa, ascending mountain regions, thus perhaps hardy here with us. Dr. Kirk found the green bunches, if immersed in water for half a day, suddenly to assume a scarlet hue, and then the astringent pulp to become edible and sweet.

Phormium tenax, J. R. and G. Forster.*—The Flax-lily of New Zealand, where it occurs as far south as forty-six degrees and thirty minutes, occurring also in the Chatham Islands and Norfolk Island, though not on Lord Howe's Island. It seems important that this valuable plant should here be brought universally under culture, particularly on any inferior spare ground, or on the sea-beaches, or any rocky declivity, where it may be left unprotected to itself, as no pastoral animal will touch it. It is evident that the natural upgrowth will soon be inadequate to the demand for the plant. Merely torn into shreds, the leaves serve at once in gardens and vineyards as cordage; and for this purpose, irrespective of its showy aspect, the *Phormium* has been distributed from our Botanic Garden since the last 14 years. From the divided roots any plantation can gradually be increased, or this can be done more extensively still by sowing the seeds. In all likelihood the plant would thrive and become naturalized in the Auckland's and Campbell's Group, Kerguelen's Land, the Falkland Islands, the Shetland Islands, and many continental places of both hemispheres. Among the varieties, three are better characterized than the rest: The Tehore, the Swamp, and the Hill variety. The first and the last mentioned produce a fiber fine and soft, yet strong, and the plants attain a height of only about 5 feet, whereas the Swamp variety grows to double that height, producing a larger yield of a coarser fiber, which is chiefly used for rope or paper making. As might be expected, the richer the soil the more vigorous the growth of the plant; it likes, moreover, now and then to be overflowed by fresh or

brackish water, but it will not live if permanently sunk into wet. In swampy ground trenches should be dug to divert the surplus of humidity. Fiber free from gum-resin, properly dressed, withstands moisture as well as the best Manila rope. Carefully prepared, the fiber can also be spun into various textile, durable fabrics, either by itself or mixed with cotton, wool, or flax. In October last, the sale of Phormium fiber in London was 11,500 bales, ranging in price from £19 to £31. The tow can also be converted into paper, distinguished for its strength and whiteness. The London price of Phormium fiber for this purpose is from £10 to £20 per ton.

For further details on the utilization of this plant the elaborate reports of the New Zealand Commission for Phormium should be consulted. One of the dwarf varieties is *Phormium Colensoi*, J. Hook.

Physalis Alkekengi, L.—The Strawberry Tomato, or Winter Cherry. Middle and South Europe, North Africa, Middle Asia, extending to Japan; said to have come originally from Persia. A perennial herb. The berry, which is red, and of a not unpleasant taste, has some medicinal value. The leaves contain a bitter principle—*Physalin*.

Physalis angulata, L.—In many tropical countries, extending as a native plant to the northern parts of the United States and to Japan. An annual herb. Yellowish; the berries edible. *P. minima*, L. (*P. parviflora*, R. Br.), appears to be a variety, and extends also into tropical Australia.

Physalis Peruviana, L.—Temperate and tropical America; widely naturalized in many countries of the warmer zones. With double inaptness called the

Cape Gooseberry. A perennial herb ; but, for producing its work well, it requires early renovation. The acidulous berries can be used as well for a table-fruit as for preserves. Doubtless several other kinds of *Physalis* can be utilized in the same manner. In colder countries the *P. Peruviana* becomes annual.

Pimpinella Anisum, L.—The Anise Plant. Greece, Egypt, Persia. An annual. The seed-like fruit enters into various medicines and condiments, and also required for the distillation of oil, rich in anethol.

Pimpinella Saxifraga, L.—Europe, North and Middle Asia. A perennial herb ; its root used in medicine ; a peculiar volatile oil can be distilled from the root. *P. magna*, L., is a closely-allied species, and *P. nigra*, W., is a variety. The root of the last is particularly powerful.

Pimpinella Sisarum, Benth. (*Sium Sisarum*, L.)—East Asia. A perennial herb. The bunches of small tubers afford an excellent culinary vegetable.

Pipturus propinquus, Weddell. —Insular India, South Sea Islands, and warmer parts of East Australia. This bush is higher and rather more hardy than *Boehmeria nivea* ; but, in fiber, it is similar to that plant. *P. velutinus*, Wedd., is closely allied. The few other species serve probably as well for fiber.

Pistacia Lentiscus, L. — The Mastic - tree. The Mediterranean regions. A tall, evergreen bush, exuding the mastic resin mostly through incisions into its bark. In Morocco it is very extensively used for hedges.

Pistacia Terebinthus, L. — Countries around the Mediterranean Sea. A tall bush or small tree, with deciduous foliage. The fragrant Cyprian or Chio tur-

pentine exudes from the stem of this species. *P. vera*, L., is inserted already among the timber-trees.

Pisum sativum, L.*—The Common Pea. Mediterranean countries, and Western Asia. This annual, of daily use, could hardly be left disregarded on this occasion. Suffice it to say, that the herbage, as a nutritious fodder, deserves more attention than it receives. The green fruit contains Inosit-sugar and Cholesterin-fat. A second species, *P. Aucheri*, Jaub. and Spach., which is perennial, occurs in alpine elevations on the Taurus.

Plectocomia Himalayana, Griffith. — Sikkim, up to 7,000 feet. This Rattan-palm requires moist forest-land. Its canes are not durable, but this palm is an object worthy of horticulture, and would prove the hardiest among its congeners.

Poa angustifolia, L. (*P. serotina*, Ehrh., *P. fertilis*, Host.) — Europe, North Asia, North America. A perennial pasture-grass, allied to *P. nemoralis*. An excellent grass for moist meadows and river-banks.

Poa aquatica, L. (*Glyceria aquatica*, Sm.) — Europe, North and Middle Asia, North America. This conspicuous water-grass attains a height of 6 feet. It is perennial, and deserves naturalization in our swamps.

Poa Brownii, Kunth. (*Eragrostis Brownii*, Nees.)—Tropical and Eastern extra-tropical Australia, extending rather widely through our colony. It is here mentioned as a valuable perennial species, keeping beautifully green in our driest Summers, even on poor soil. The section *Eragrostis*, of the genus *Poa*, contains numerous species in the hotter parts of the globe. Of these many would doubtless be hardy here and prove of pastoral value.

Poa cynosuroides, Retz. — North-eastern Africa, South Asia. A harsh perennial grass, not serviceable for fodder, but mentioned by Royle as a fiber-plant of North-western India, where it is valued as a material for ropes. In this respect it may not surpass the rough, tufty variety of our own *Poa Australis*, R. Br., so common on our river-banks, from the leaves of which excellent nets are made by the natives.

Poa distans, L.—Europe, North Africa, Middle and Northern Asia, North America. Perennial. It is one of the limited number of tender grasses suited for moist saline soil, and thus affords pasturage on coast marshes.

Poa fluitans, Scopoli. (*Glyceria fluitans*, R. Brown.) — Europe, North Africa, Middle and North Asia, North America. The Manna-Grass. Perennial. Excellent for stagnant water and slow-flowing streams. The foliage is tender. The seeds are sweet and palatable, and are in many countries used for porridge.

Poa maritima, Hudson. — Europe, North Africa, North Asia, North America. Its long, creeping roots help to bind the coast-sand. This grass can also be depastured.

Poa nemoralis, L.—Europe, North and Middle Asia, North America. This perennial grass can be grown on shady forest-land, as the name implies, but it accommodates itself also to open places, and will grow even among rocks. It endures alpine Winters.

Poa pratensis, L.—The ordinary English Meadow-Grass. A perennial species, fit for any meadows; thriving early, and able to live also in alpine localities. Better adapted for pasture than hay, but by no means one of the very best grasses, though it resists

drought. It forms excellent sward, and with advantage can be used for intermixing it with other pasture-grasses.

Poa trivialis, L.* — Europe, North Africa, Middle and Northern Asia. Also a good perennial grass for mixture on pasture-land. One of the best grasses for sowing on ground recently laid dry. Sinclair regarded the produce of this *Poa* as superior over many other kinds, and noticed the marked partiality which horses, oxen, and sheep evince toward it. To thrive well it wants rather moist and rich soil and sheltered places.

These few species of *Poa* have been singled out as recommendable, because they are well tested. Future experiments beyond Europe will add others to lists of recommendations like this.

Podophyllum peltatum, L. — North America. A perennial forest-herb, not without importance for medicinal purposes. The root contains the bitter alkaloid Berberin. *Podophyllum Emodi*, Wall., occurring in the Indian mountains, at a height from 6,000 to 14,000 feet, can probably be used like the American species. The berries of both are edible, though the root and leaves are poisonous.

Pogostemon Patchouli, Pellet. — Mountains of India. A perennial herb, famed for its powerful scent, arising from a volatile oil. *P. parviflorus*, Benth., and *P. Heyneanus*, Benth., belong to this species.

Polygala Senega, L. — North America. A perennial herb. The root is of medicinal value; its acrid principle is Saponin.

Prangos pabularia, Lindley. — Plateaus of Mongolia and Tibet. A perennial fodder-herb, much relished

by sheep, eligible for cold and arid localities, and deserving naturalization on our alpine pasture-ground. Other perennial species exist near the Mediterranean Sea, on the Atlas, the Caucasus, and the Indian Highlands. *P. pabularia* is regarded by some as the *Silphium* of Arrianus.

Pringlea antiscorbutica, W. Anderson and R. Br.*—The Cabbage or Horse Radish of Kerguelen's Island. The perennial, long roots taste somewhat like Horse-radish. The leaves in never-ceasing growth are crowded, cabbage-like, into heads, beneath which the annual flower-stalks arise. The plant ascends mountains in its native island to the height of 1,400 feet, but luxuriates most on the sea-border. To arctic and other antarctic countries it would be a boon. Probably it would live not only on our shores, but also on our Alps. Whalers might bring us the roots and seeds of this remarkable plant, which seems to have never entered into culture yet. Not even its flowers in a perfect state are known. The plant was used by the celebrated Captain Cook and all subsequent navigators, touching at yonder remote spot, as cabbage, and it proved to possess powerful properties against scurvy. Dr. Hooker observes that *Pringlea* can sectionally be referred to *Cochlearia*. The whole plant is rich in a pungent, volatile oil. Through culture important new culinary varieties may likely be raised from this plant. The taste of this vegetable in its natural growth is like mustard and cress, and the Kerguelen's Land Cabbage, when boiled, proved a wholesome and agreeable substitute for the ordinary cabbage.

Prosopis dulcis, Kunth.—From Mexico to the south-

ern parts of the La Plata States. A thorny shrub, growing finally to a tree, adapted for live-fences. This is one of the species yielding the sweetish Algarobapods for cattle-fodder, and utilized even in some instances for human food. As allied plants, beside the following, may be mentioned: *P. horrida*, Humb., occurring from the base of the Andes to the sand-shores of Peru; *P. juliflora*, Cand., growing from Mexico and West India to Ecuador; *P. Siliquastrum*, Cand., extending from the Chilean Andes apparently into the Argentine Province Catamarca. A short communication on the American Algaroba-trees was presented to our Parliament by the writer, in 1871.

Prosopis glandulosa, Torrey.—Colorado, Arkansas, Texas. The pods of this thorny evergreen shrub or tree are also succulent. It exudes a gum, not unlike Gum Arabic, and this is obtained so copiously that children could earn from two dollars to three dollars a day in Texas while gathering it—latterly about 40,000 lbs. being bought by druggists there. The tree attains a height of 30 feet, and its wood is excessively hard. The pods of several species are rich in tannin.

Prosopis pubescens, Benth.—Texas, California, New Mexico. Likely available for hedges, with other species of other countries.

Prosopis spicifera, L.—India. A thorny tree, also with edible pods; possibly hardy here.

Prosopis Stephaniana, Kunth.—Syria and Persia. A shrubby species for hedge-growth.

Prunus Americana, Marshall. (*P. nigra*, Aiton.)—Canada, Eastern United States of America. A thorny tree, furnishing the yellow and red plum of North

America. The fruit is roundish and rather small, but of pleasant taste.

Prunus Chisasa, Michaux.—North America, west of the Mississippi. On the prairies it is only 3 to 4 feet high. Fruit spherical, red, rather small, with a tender, usually agreeable pulp. Other species with edible fruit occur in North America, such as *P. pumila*, L., *P. Pennsylvanica*, L., *P. Virginiana*, L., *P. serotina*, Ehrh., but their fruits are too small to render these plants of importance for orchard culture, though they may also become enlarged by artificial treatment.

Prunus maritima, Wangenheim.—The Beach Plum of North America. A shrubby species, of service not only for covering coast-sands, but also for its fruit, which is crimson or purple, globular, and measuring from a half to one inch. It is not necessary to enter here any notes on the generally-known species of *Prunus*, which have engaged already for years the keen attention of many orchard cultivators also in this colony. Thus we possess, in the country, numerous, though not all the best varieties of the cherry (*P. avium*, L., and *P. Cerasus*, L.), of the plum (*P. domestica*, L.), of the apricot (*P. Armeniaca*, L.), and of the cherry-plum (*P. myrobalana*, L.), the latter Canadian, the others European and Oriental. Information on these and other varieties, to which we have added independently also here, may be sought in "Hogg's Fruit Manual." The almond (*Amygdalus communis*, L.), and the peach (*Amygdalus Persica*, L.) belong also generically to *Prunus*, as indicated in 1813, by F. G. Hayne ("Arznei Gewaechse," iv., 38), and finally settled by J. D. Hooker (Benth. and Hook.,

gen. pl. i., 610), for which, therefore, now the names *P. Amygdalus* and *P. Persica* should be adopted.

Prunus spinosa, L.—The Sloe or Blackthorn. Wild in many parts of Europe. With its flowers it is one of the earliest plants to announce the Spring. Its tendency to throw out suckers renders the bush less adapted for hedges of gardens than of fields, but these suckers furnish material for walking-sticks. The small fruits can be made into preserves. *P. insititia*, L., the Bullace, with larger and sometimes yellow fruits, extends to North Africa and Middle Asia. Dr. Hooker, and other phytographers, consider *P. domestica* not specifically distinct from *P. spinosa*. Of medicinal value are *P. Lauro-Cerasus*, L., the evergreen Cherry-Laurel from the Orient, and *P. Padus*, L., the deciduous Bird's cherry, which extends from Europe to North Africa and West Asia. These, and most other species, contain, in their foliage and in some other parts, Amygdalin. Perhaps some of the species from Eastern Asia, California, and tropical America are eligible for improving their fruit through horticultural skill. The Sloe and others might, with advantage, be naturalized on our forest-streams.

Psamma arenaria, Roem. and Schult. (*P. littoralis*, Beauv.; *Calamagrostis arenaria*, Roth.)—The Moram, or Marrem, or Bent Grass. Sand-coasts of Europe, North Africa, and Middle North America. One of the most important of reedy grasses, with long, creeping roots, for binding the moving drift-sands on the sea-shore, for the consolidation of which, in Europe chiefly, this tall grass and *Elymus arenarius* are employed. *Psamma Baltica*, R. and S., from the Baltic and North Sea, serves the same purpose. Both

can also be used in the manner of Sparta for paper material.

Psidium Araca, Raddi. — From West India and Guiana, to Peru and Southern Brazil, where it is found in dry, high-lying places. This is one of the edible Guavas, recorded already by Piso and Marcgrav. The greenish-yellow berry is of exquisite taste.

Psidium arboreum, Vellozo. — Brazil; province Rio de Janeiro. This Guava fruit measures about one inch, and is of excellent flavor.

Psidium Cattleyanum, Sabine.* — The Purple Guava. Brazil and Uruguay. One of the hardiest of the Guava bushes, attaining finally a height of 20 feet. The purple berries are seldom above an inch long, but of delicious flavor and taste, resembling, thus far, strawberries. *P. buxifolium*, Nutt., of Florida, seems nearly related to this species.

Psidium cinereum, Martius. — Brazil; provinces Minas Geraes and Sao Paulo. Also yielding an edible fruit.

Psidium cordatum, Sims. — The Spice Guava. West India. This one attains the height of a tree, Its fruit edible.

Psidium cuneatum, Cambess. — Brazil; province Minas Geraes. Fruit greenish, of the size of a Mirabelle Plum,

Psidium grandifolium, Martius. — Brazil; provinces Rio Grande do Sul, Parana, Sao Paulo, Minas Geraes, where the climate is similar to Southern Queensland. A shrub of rather dwarf growth. The berries edible, size of a walnut.

Psidium Guayava, Raddi.* (*P. pomiferum*, L., *P. pyriferum*, L.) — The large Yellow Guava. From West

India and Mexico to South Brazil. For this handsome evergreen and useful bush universal attention should be secured anywhere in our warm lowlands, for the sake of its aromatic, wholesome berries, which will attain the size of a hen's egg and can be converted into a delicious jelly. The pulp is generally cream-colored or reddish, but varies in the many varieties which have arisen in culture, some of them bearing all the year round. Propagation is easy from suckers, cuttings, or seeds. Many other berry-bearing Myrtaceæ (of the genera *Psidium*, *Myrtus*, *Myrcia*, *Marliera*, *Calyptranthes*, *Eugenia*) furnish edible fruits in Brazil and other tropical countries, but we are not aware of their degrees of hardiness. Berg enumerates as esculent more than half a hundred for Brazil alone, of which the species of *Campomanesia* may safely be transferred to *Psidium*.

Psidium incanescens, Martius.—Brazil; from Minas Geraes to Rio Grande du Sul. This Guava-bush attains a height of 8 feet. Berry edible.

Psidium polycarpon, Al. Anderson.*—From Guiana to Brazil, also in Trinidad. A comparatively small shrub, bearing prolifically and almost continuously its yellow berries, which are of the size of a large cherry and of exquisite taste.

Psidium rufum, Martius.—Brazil, in the province Minas Geraes, on sub-alpine heights. This Guava-bush gains finally a height of 10 feet, and is likely the hardiest of all the species, producing palatable fruit.

Ptychosperma Alexandræ, F. v. Mueller.—The Alexandra Palm. Queensland, as well in tropical as extra-tropical latitudes. The tallest of Australian Palms, and one of the noblest form in the whole em-

pire of vegetation. It exceeds 100 feet in height, and is likely destined to grace any shady moist grove free from frost in this and other countries, as it seems less tender than most palms. The demand for seeds has already been enormous.

Ptychosperma Cunninghami, Wendland. — East Australia, as far south as Illawarra; thus one of the most southern of all palms. This also is a very high species, destined to take here a prominent position in decorative plantations. Several species occur in Fiji and other islands of the Pacific Ocean, and again others might be obtained from India, but they are probably not so hardy as ours. Though, strictly speaking, of no industrial value, these palms are important for horticultural trade, and are objects eminently fitted for experiments in acclimation.

Ptychosperma elegans, Blume. (*P. Seaforthia*, Miq.; *Seaforthia elegans*, R. Br.)—Litoral forests of tropical Australia. Also a lofty magnificent Feather-Palm. Its leaflets are erose. It may prove hardy.

Pycnanthemum incanum, Michaux.—North America. A perennial herb, in odor resembling both pennyroyal and spearmint. It likes to grow on rocky woodland, and on such it might be easily naturalized.

Pycnanthemum montanum, Michaux.—The Mountain Mint of North America. A perennial herb of pleasant, aromatic, mint-like taste. These two particular species have been chosen from several North American kinds, to demonstrate that we may add by their introduction to the variety of our odorous garden-herbs. They may also be subjected with advantage to distillation.

Pyrrularia edulis, Meisner. — Nepaul, Khasia, Sik-

kim. A large, umbrageous tree. The drupaceous fruit is used by the inhabitants for food. A few other species occur in Upper India, one on the high mountains of Ceylon and one in North America. The latter, *P. pubera*, Mich., can be utilized for the oil of its nuts.

Pyrus coronaria, L. — The Crab-apple of North America. This showy species is mentioned here as worthy of trial-culture, since it is likely that it would serve well as stock for grafting. It seems unnecessary to refer here to any of the forms of *Pyrus communis*, L., *P. Malus*, L., *P. Cydonia*, L., and *P. Germanica*, J. Hook. (*Mespilus Germanica*, L.), but it may passingly be observed that curious fruits have been produced latterly in North America by the hybridization of the apple with the pear. A bitter Glycosid, namely, Phlorrhizin, is obtainable from the bark of apple and pear trees, particularly from that of the root, while a volatile alkaloid, namely, trimethylamin, can be prepared from the flowers.

Quercus Mongolica, Fischer.*—Mandschuria. One of the two species on which mainly (if not solely) the silk insect peculiar to oak-trees is reared, as shown by Dr. Hance. *Q. serrata*, Thunb. (*Q. obovata*, Bunge), the second of the principal oaks for the production of silk, has been mentioned previously in the Acclimatization Society's list of trees yielding timber, and has, through the exertions of the writer, found its way already to Australia.

Rafnia amplexicaulis, Thunberg. — South Africa. The root of this bush is sweet, like liquorice, and is administered in medicine. *Rafnia perfoliata*, E. Meyer, also from South Africa, furnishes likewise a medicinal root.

Reseda Luteola, L.—The Weld. Middle and South Europe, Middle Asia, North Africa. An herb of one or two years' duration. A yellow dye (Luteolin) pervades the whole plant.

Reseda odorata, L.—The true Mignonette. North Africa and Syria. An herb of one or very few years' duration. The delicate scent can best be concentrated and removed by enfleurage.

Rhamnus catharticus, L. — The Buckthorn. Middle and South Europe, North Africa, Middle Asia. It can be utilized as a hedge-plant. The berries are of medicinal value, as indicated by the specific name. The foliage and bark can be employed for the preparation of a green dye.

Rhamnus chlorophorus, Lindl.—China. From the bark a superior green pigment is prepared. *R. utilis*, from the same country, serves for the like purpose. This kind of dye is particularly used for silk, and known as Lokao.

Rhamnus infectorius, L. — On the Mediterranean Sea, and in the countries near to it. The berry-like fruits of this shrub are known in commerce as Graines d'Avignon and Graines de Perse, and produce a valuable green dye. Other species seem to supply a similar dye-material — for instance, *R. saxatilis*, L., *R. amygdalinus*, Desf., *R. oleoides*, L.

Rhapis flabelliformis, L. fil. — China and Japan. This exceedingly slender palm attains a height of only a few feet. The stems can be used for various small implements. It is one of the best plants for table decoration.

Rhaponticum acaule, Cand.—On the Mediterranean Sea. A perennial herb. The root is edible.

Rheum australe, Don.* (*R. Emodi*, Wall.; *R. Webbianum*, Royle.) — Himalayan regions, up to 16,000 feet. From this species at least a portion of the medicinal rhubarb is obtained. Most likely several species furnish rhubarb-root, and its quality depends probably much on the climatic region and the geologic formation in which the plant grows. Should we wish to cultivate any species here for superior medicinal roots, then, clearly, localities in our higher and drier alpine tracts should be chosen for the purpose. Hayne regards the presence of much yellowish pigment in the seed-shell as indicating a good medicinal rhubarb-plant. As much as 5 lbs. of the dried drug are obtained from a single plant, several years old. An important orange-red crystalline substance, Emodin, allied to Crysophanic acid, occurs in genuine rhubarb.

Rheum Rhaponticum, L.—From the Volga to Central Asia. This species, together with *R. Tataricum*, L. fil., *R. undulatum*, L., and a few others, all Asiatic (one extending to Japan), provide their acidulous leaf-stalks and unexpanded flower-mass for culinary purposes. Rhubarb-leaves can also be used in the manner of spinach. *R. palmatum*, L., often considered to yield the best rhubarb-root, is an insular plant of North-eastern Asia, but may, in the alpine deserts far inland, become a source of the genuine root, so long ascribed to it. That is the only one with deeply-jagged leaves.

Rhus copallina, L. — North America, extending to Canada. A comparatively dwarf species. This can also be used for tanning. A resin for varnishes is also obtained from this shrub.

Rhus Coriaria, L.*—The Tanner's Sumach. Coun-

tries around the Mediterranean Sea. The foliage of this shrub or small tree, reduced to powder, forms the sumach of commerce. Many localities in our colony are particularly well adapted for the growth of this bush. It is remarkably rich in tannic acid, yielding as much as 30 per cent., and extensively used for the production of a superior Corduan or Maraquin-leather. The cultivation presents no difficulty. Sumach can also be used for ink and various particularly black dyes. Under favorable circumstances as much as a ton of sumach is obtained from an acre.

Rhus Cotinus, L.—The Scotino. Countries at the Mediterranean Sea. The wood of this bush furnishes a yellow pigment. The scotino, so valuable as a material for yellow and black dye, and as a superior tanning substance, consists of the grinded foliage of this plant.

Rhus glabra, L.—North America, extending to 54° N. L. This sumach shrub will grow on rocky and sterile soil. It produces a kind of gall, and can also be used as a good substitute for the ordinary sumach. This species can easily be multiplied from suckers. It will live on poor soil. American sumachs contain generally from 15 to 20 per cent. tannin.

Rhus lucida, L.—South Africa. This shrub proved here of particular adaptability for forming hedges. About half a hundred South African species are known, of which probably some could be utilized like ordinary sumach, but hitherto we have remained unacquainted with the nature and degree of any of their tanning and coloring principles.

Rhus semialata, Murray.—China and Japan. This shrub produces a kind of nut-galls.

Rhus typhina, L.—The Staghorn Sumach. North America, extending to Canada. This species will grow to a tree of 30 feet high. Its wood is of an orange tinge. Through incisions into the bark a kind of copal is obtained. The leaves can be used like ordinary sumach. This bush can be reared on inferior land.

Ribes aureum, Pursh.—Arkansas, Missouri, Oregon. This favorite bush of our shrubberies would likely on our forest-streams produce its pleasant berries, which turn from yellow to brown or black. Allied to this is *R. tenuiflorum*, Lindl., of California and the nearest States, with fruits of the size of red currants, of agreeable flavor, and either dark purple or yellow color.

Ribes divaricatum, Douglas.—California and Oregon. One of the gooseberries of those countries. Berries smooth, black, about one third of an inch in diameter, pleasant to the taste. Culture might improve this and many of the other species. *R. Nuttalli* (*R. villosum*, Nutt., not of Gay, nor of Wallich) is an allied plant, also from California.

Ribes Floridum, P'Heritier.—The Black Currant of North America. The berries resemble in odor and taste those of *R. nigrum*. Allied to this is *R. Hudsonianum*, Rich., from the colder parts of North America.

Ribes Griffithi, J. Hook. and T. Thoms.—Himalaya at a height of 10,000 to 13,000 feet. Allied to *R. rubrum*, bearing similar but larger berries of somewhat austere taste. The naturalization of this currant-bush on our highest alps may prove of advantage. *R. laciniatum*, H. and T., is likewise a Himalayan species

with red berries, and so *R. glaciale*, Wall. Furthermore, *R. villosum*, Wall. (*R. leptostachyum*, Decaisne), comes from the Indian highlands and seems worthy of introduction.

Ribes Grossularia, L. — The ordinary Gooseberry. Europe, North Africa, Western Asia, on the Himalayan Mountains, up to a height of 12,000 feet. This bush, familiar to every one, is mentioned here merely to indicate the desirability of naturalizing it in our alpine regions, where no fruits equal to it in value exist.

Ribes hirtellum, Michaux. — The commonest smooth Gooseberry of North America. It likes moist ground.

Ribes nigrum, L. — The Black Currant. Middle and Northern Asia, Europe, North America, ascending the Himalayan and Tibet mountains to a height of 12,000 feet. Commonly cultivated already in the cooler parts of Victoria, but also particularly fit to be dispersed through our forests and over our alps.

Ribes niveum, Lindl. — One of the Oregon Gooseberry-bushes. Berries small, black, of a somewhat acid taste, and rich vinous flavor.

Ribes rotundifolium, Michaux. — North America. Yields part of the smooth gooseberries of the United States. The fruit is small, but of delicious taste.

Ribes rubrum, L. — The ordinary Red Currant. Europe, North America, North and Middle Asia; in the Himalayan Mountains ceasing where *R. Griffithi* commences to appear. One of the best fruit-plants for jellies and preserves that could be chosen for the colder mountain altitudes of our colony. The root-bark contains Phlorrhizin. Perhaps other species than those recorded here, among them some from the

Andes, may yet deserve introduction, irrespective of their showiness, for their fruits.

Ricinus communis, L.*—The Castor-oil plant. Indigenous to the tropical and sub-tropical zones of Asia and Africa. A shrubby, very decorative plant, attaining the size of a small tree. It was well known to the Egyptians 4,000 years ago, and is also mentioned already in the writings of Herodotos, Hippocrates, Dioscorides, Theophrastos, Plinius, and other ancient physicians, philosophers, and naturalists. The easy and rapid growth, the copious seeding, and the early return of produce render this important plant of high value in a clime like ours, more particularly as it will thrive on almost any soil, and can thus be raised even on arid places, without being scorched by hot winds. It may thus become an important plant also for culture in our desert-tracts, and is evidently destined to be one of our most eligible oil-plants for technical uses, irrespective of the value of its oil for medicinal purposes. The seeds contain about 50 per cent. oil. To obtain the best medicinal oil, hydraulic pressure should be employed, and the seeds not be subjected to heat; the seed-coat should also be removed prior to the extracting process being proceeded with. A screw-press suffices, however, for ordinary supply, to obtain the oil. By decantation and some process of filtration it is purified. For obtaining oil to be used for lubrication of machinery or other technologic purposes, the seeds may be pressed and prepared by various methods, under application of heat and access of water. Castor-oil is usually bleached simply by exposure to solar light, but this procedure lessens to some extent the laxative properties of the

oil. It dissolves completely in waterless alcohol and in ether, and will become dissolved also in spirit of high strength, to the extent of three fifths of the weight of the latter. Solutions of this kind may become valuable for various technic purposes, and afford some tests for the pureness of the oil. If pressed under heat it will depose margaritin. Heated in a retort, about one third of the oil will distill over, and a substance resembling india - rubber remains, which saponizes with alkalies. Other educts are at the same time obtained, which will likely become of industrial value. These facts are briefly mentioned here, merely to explain that the value of this easily - produced oil is far more varied than is generally supposed, and this remark applies with equal force to many other chemical compounds from vegetable sources, briefly alluded to in this present enumerative treatise. The seeds contain also a peculiar alkaloid : Ricinin. The solid chemic compound of Castor-oil is the crystalline Isocetin-acid (a glycerid). The oil contains also a non-crystalline acid peculiar to it (ricin-acid). For the production of a particular kind of silk the *Ricinus*-plant is also important, inasmuch as the hardy *Bombyx Cynthia* requires for food the leaves of this bush. The value of Castor-oil imported last year into Victoria was, according to the Customs-returns, not less than £23,755. Even a few of the seeds, if swallowed, will produce poisonous effects.

Rosa contifolia, L. — The Cabbage Rose. Indigenous on the Caucasus, and seemingly, also, in other parts of the Orient. Much grown in South Europe and South Asia for the distillation of rose-water and oil, or attar of roses. From 12,000 to 16,000 roses,

or, from 250 pounds to 300 pounds of rose-petals are required, according to some calculations, for producing a single ounce of attar, through ordinary distillation. The flowers require to be cut just before expansion; the calyx is separated and rejected; the remaining portions of the flowers are then subjected to aqueous distillation, and the saturated rose-water, so obtained, is repeatedly used for renewed distillation, when, from the overcharged water, the oil separates on a cold place, and floats on the surface. But some other methods exist for producing the oil; for instance, it may be got by distilling the rosebuds without water, at the heat of a salt-water bath. The odor may also be withdrawn by alcoholic distillation from the roses, or be extracted by the "enfluerage" process. The latter is effected by placing the flowers, collected while the weather is warm, into shallow frames, covered with a glass-plate, on the inner side of which a pure, fatty substance has been thinly spread. The odor of the flowers is absorbed by the adipose or oleous substance, though the blossoms do not come in direct contact with it; fresh flowers are supplied daily for weeks. The scent is finally withdrawn from its matrix by maceration with pure alcohol. Mr. Joseph Bosisto's method for obtaining the most delicate and precious volatile oils will likely be applicable also to the rose, and prove more advantageous, both in labor and gain, than any other process. Purified eucalyptus-oil can be used for diluting rose-oil, when it is required for the preparation of scented soap.

Rosa Damascena, Miller. — Orient. Allied to the preceding species, and also largely used for the production of essential oil of roses.

Rosa Gallica, L.—The French or Dutch rose. Middle and South Europe, Orient. The intensely-colored buds of this species are particularly chosen for drying. These, however, may be got also from other kinds of roses.

Rosa Indica, L.—Noisette Rose. From Upper India to China and Japan. Some roses of the sweetest scent are derived from this species.

Rosa lævigata, Michaux. (*R. Sinica*, Aiton.)—The Cherokee Rose. China and Japan. Considered one of the best hedge-roses, and for that purpose much employed in North America. It serves also well for bowers. Allied to the foregoing species.

Rosa moschata, Miller. —North Africa and South Asia as far east as Japan. From the flowers of this extremely tall, climbing species, also, essential oil is obtained. The attar thus derived from roses of not only different varieties but even distinct species must necessarily be of various quality.

Rosa sempervirens, L.—From South Europe through Southern Asia to Japan. One of the best rose-bushes for covering walls, fences, and similar structures. Also, the flowers of this species can be utilized for rose-oil.

Rosa setigera, Michaux.—North America, where it is the only climbing rose-bush. It deserves introduction on account of its extremely rapid growth, 10 feet to 20 feet in a season. Its flowers, however, are nearly inodorous.

Other original species of Roses deserve our attention, Dr. J. Hooker admitting about 30, all from the northern hemisphere. But on the snow-clad, unascended mountains of Borneo, Sumatra, New Guinea,

and Africa south of the Equator, yet perhaps new roses may be discovered, as they have been traced South to Abyssinia already.

Rosmarinus officinalis, L.—The Rosemary. Countries around the Mediterranean Sea. This well-known bush is mentioned here as a medicinal plant, from which a distilled oil is rather copiously obtainable. One of our best plants for large garden edgings. The oil enters into certain compositions of perfumery.

Rubia cordifolia, L. (*R. Mungista*, Roxb.)—From the Indian Highlands through China and Siberia to Japan ; also occurring in various parts of Africa, as far south as Caffraria and Natal. This perennial plant produces, also, a kind of Madder. Probably other species yield likewise dye-roots. The genus is represented widely over the globe, but, as far as known, not in Australia.

Rubia tinctorum, L.—The Madder. Countries around the Mediterranean Sea. A perennial herb of extremely easy culture. The roots, merely dried and pounded, form the dye. The chemical contents are numerous ; in the herb : Rubichloric and Rubitannic acid ; in the root : Alizarin, Purpurin, Rubiacin, Rubian, Ruberythrin acid, and three distinct resins ; also Chlorogenin, Xanthin and Rubichloric acid. On the five first depend the pigments produced from the root. Madder is one of the requisites for Alizarin Ink.

Rubus Canadensis, L.*—The Dewberry of North America. A shrub of trailing habit. Fruit black, of excellent taste, ripening earlier than that of *R. villosus*, Ait., which constitutes the High Blackberry of the United States, with large fruits.

Rubus Chamæmorus, L.—The Cloud-berry. North

Europe, North Asia, North America, particularly in the frigid zone. A perennial but herbaceous plant; a pigmy among its congeners. Nevertheless it is recommended for introduction to our spongy, mossy, alpine moors, on account of its grateful amber-colored or red fruit. All the species can readily be raised from seeds. *R. Arcticus*, L., also with edible fruit, is in the high north usually its companion. Near to us we have a similar little herb, living for a great part of the year in snow, namely *Rubus Gunnianus*, Hook. It occurs on the alpine heights of Tasmania, from whence it might be easily transferred to our snowy mountains and those of New Zealand. The fruit of *R. Gunnianus* is red and juicy, but not always well developed.

Rubus cuneifolius, Pursh.—The Sand Blackberry. North America. A dwarf shrub. The fruit is of agreeable taste.

Rubus deliciosus, Torrey. — On the sources of the Missouri. An erect shrub. Fruit raspberry-like, large, and grateful.

Rubus fruticosus, L.*—The ordinary Blackberry or Bramble. All Europe, North Africa, Middle and Northern Asia. This shrub bears well in our clime. In some countries it is a favorite plant for hedges. It likes, above all, calcareous soil, though it is content with almost any, and deserves to be naturalized on the rivulets of our ranges. *R. corylifolius*, Sm., *R. suberectus*, Andr., and *R. leucostachys*, Sm., are varieties like many other named kinds of European blackberries, or perhaps belong to the closely-allied *R. cæsius*, L., the English dewberry; or, in some instances, hybrid forms may have arisen from the

two, although the generality of these various black-berry-bushes bear their fruits freely enough.

Rubus Idæus, L.*—The ordinary Raspberry. Europe, Northern and West Asia. It is mentioned here to point out the desirability of naturalizing the plant in our mountains and on river-banks. It would live also on our highest alps, where the native raspberry (*R. parvifolius*, L.) produces much finer fruits than in our lowlands. The fruits contain stereopten.

Rubus macropetalus, Douglas.*—California and Oregon. An unisexual shrub. Fruit black, oval-cylindric, particularly sweet.

Rubus occidentalis, L.* — The Black Raspberry or Thimbleberry. North America. A species with woody stems and nice fruits, with a glaucous bloom, well-flavored and large. It ripens early.

Rubus odoratus, L.* — North America. A kind of Raspberry. A handsome species on account of its large, purple flowers. Berry edible. Culture would doubtless enhance the value of the fruits of many of these Rubi. Hybridizing might be tried.

Rubus strigosus, Michaux. — N. America. Closely allied to the European Raspberry. Its fruits large, also of excellent taste. It would lead too far to enumerate other kinds of *Rubus*, although about a hundred genuine species occur, which render the genus one of very wide dispersion over the globe.

Rubus trivialis, Michaux.* — Southern States of North America. Another shrubby species, with good edible fruits, which are large and black. The plant will thrive in dry, sandy soil.

Rumex Acetosa, L.—The Kitchen Sorrel. Europe, Middle and North Asia to Japan; also in the frigid

zone of North America. A perennial herb. The tender varieties, particularly the Spanish one, serve as pleasant, acidulous vegetables, but must be used in moderation, as their acidity, like that of the species of *Oxalis* (Wood-sorrel), depends on binoxylate of potash.

Rumex scutatus, L.—The French Sorrel. Middle and South Europe, North Africa, Orient. Also perennial, and superior to the foregoing as a culinary plant. Both and the following are of use against scurvy, and most easily reared.

Rumex vesicarius, L.—South Europe, Middle Asia, North Africa. An annual herb, of similar utility as the two former ones.

Ruta graveolens, L. — The Rue. Mediterranean countries and the Orient. The foliage of this acrid and odorous shrub, simply dried, constitutes the Rue herb of medicine. The allied *R. silvestris*, Mill., is still more powerful in its effect. The plants and others of the genus contain a peculiar volatile oil, and a glycosid (Rutin).

Sabal Adansoni, Guernsent. — Dwarf Palmetto. South Carolina, Georgia, and Florida. A stemless Fan-palm, with the two following and *Chamærops* attaining the most northerly positions of any American palms.

Sabal Palmetto, Roem. and Schult.*—Extends from Florida to North Carolina. The stem attains a height of 40 feet. This noble palm ought to grow on our sandy coast-tracts, as in such it delights to live.

Sabal serrulata, R. and S. — South Carolina Georgia, and Florida. The stem grows to 8 feet high. The leaves can be used for cabbage-tree hats and other purposes, for which palm-leaves are sought.

Saccharum officinarum, L.—The Sugar-cane. India, China, South Sea Islands ; not indigenous in any part of America or Australia. Sugar-cane having been cultivated in Spain and other countries on the Mediterranean Sea, it will be worthy of further trial, whether in the warmest parts of our colony, under similar climatic conditions, sugar, from cane, can be produced to advantage. Though the plant will live unprotected in the vicinity of Melbourne, it thrives there not sufficiently for remunerative culture. But it may be otherwise in East Gipps Land, or along the Murray river and its lower tributaries. In the United States the profitable culture of cane ceases at 32° N. L. ; in China it extends only to 30° N. L. In the last-mentioned country the culture of sugar-cane dates from the remotest antiquity ; moreover we have from thence a particular kind (*S. Sinense*, Roxb.), which is hardier and bears drought better than the ordinary cane ; this kind needs renewal only every second or third year, and ripens in seven months, if planted early in Spring ; but if planted in Autumn, and left standing for fully a year, the return of sugar is larger. Moderate vicinity to the sea is favorable for the growth of canes.

The multiplication of all sorts of sugar-cane is usually effected from top-cuttings, but this cannot be carried on from the original stock for an indefinite period without deterioration ; and as seeds hardly ever ripen on the canes, new plants must, from time to time, be brought from a distance. Thus New Caledonia has latterly supplied its wild-growing, splendid varieties for re-planting many sugar-fields in Mauritius. The Bourbon variety is praised as one of the richest for

sugar; the Batavian variety (*S. violaceum*, Tussac) is content with less fertile soil. Many other varieties are known. Excessive rains produce a rank luxuriance of the canes at the expense of the saccharine principle. Rich manuring is necessary to attain good crops, unless in the best of virgin soil. The lower leaves of the stem must successively be removed, also superabundant suckers, to promote the growth upward, and to provide ventilation and light. Out of the remnants of sugar-cane, molasses, rum, and taffia can be prepared. The average of sugar varies from 1 ton 6 cwt., to 3 tons for the acre. For fuller information the valuable local work of Mr. A. McKay, "The Sugar-cane in Australia," should be consulted. The stately *S. spontaneum*, L., which extends from India to Egypt, is available for scenic culture. It attains a height of 15 feet. Other tall kinds of *Saccharum* occur in South Asia.

Sagittaria lancifolia, L.—From Virginia to the Antilles. This very handsome aquatic plant can doubtless be utilized like the following species. It attains a height of 5 feet.

Sagittaria obtusa, Muehlenberg. (*S. latifolia*, Willdenow.)—North America, where it replaces the closely-allied *S. sagittifolia*. A few other conspicuous species are worthy of introduction.

Sagittaria sagittifolia, L.—Europe, North and Middle Asia, east to Japan. One of the most showy of all hardy water-plants; still not alone on that account deserving naturalization, but also because its root is edible. If once established this plant maintains its ground well, and might occupy spots neither arable nor otherwise utilized.

Salix nigra, Marshall. (*S. Purshiana*, Sprengel.)—The Black Willow of North America. It attains a height of 25 feet. This species was not included in the list of trees published by the Acclimatization Society in its last year's report. The black willow is one used for basket-work, although it is surpassed in excellence by some other species, and is more important as a timber-willow. Mr. W. Scaling, of Basford, includes it among the sorts which he recommends in his valuable publication, "The Willow," (London, 1871). From his treatise, resting on unrivaled experience, it will be observed that he anew urges the adoption of the bitter-willow (also called the rose-willow, or the whipcord-willow), *S. purpurea*, L., for game-proof hedges, the species scarcely ever being touched by cattle, rabbits, and other herbivorous animals. Not only for this reason, but also for its very rapid growth and remunerative yield of the very best of basket-material, he recommends it for field-hedges. Cuttings are planted only half a foot apart, and must be entirely pushed into the ground. The annual produce from such a hedge is worth 4s. to 5s for the chain. For additional strength the shoots can be interwoven. In rich bottoms they will grow from 7 to 13 feet in a year. The supply of basket-material from this species has fallen very far short of the demand in England. The plant grows vigorously on light soil or warp-land, but not on clay. *S. rubra*, Huds., is also admirably adapted for hedges. The real osier, *S. viminalis*, L., is distinguished by basket-makers as the soft-wooded willow, and is the best for rods, requiring two years' age, and also the most eligible for hoops, but inferior to several other species for basket-manufacture. *S.*

triandra, L., is a prominent representative of the hard-wooded basket-willows, and comprises some of the finest varieties in use by the manufacturers. A crop in the third year after planting, from an acre, weighs about 12 tons, worth £3 for the ton. *S. fragilis*, L., and *S. alba*, L., are more important as timber-willows, and for growing hoop-shoots. Their rapidity of growth recommends them also for shelter-plantations, to which advantage may be added their inflammability and their easy propagation; the latter quality they share with most willows. Mr. Scaling's renewed advocacy of the formation of willow-plantations comes with so much force that his advice is here given, though condensed in a few words. Osier-plantations come into full bearing already in the third year; they bear for ten years and then slowly decline. The raw produce from an acre in a year averages 6 tons to 7½ tons, ranging in price from £2 10s. to £3 10s. for the ton (unpeeled). Although 7,000 acres are devoted in Britain to the culture of basket-willows (exclusive of spinneys and plantations for the farmers' own use), yet, in 1866, there had to be imported from the Continent 4,400 tons of willow-branches, at a value of £44,000, while, besides, the value of the made baskets imported in that year was equal to the above sum. Land comparatively valueless for root or grain-crops can be used very remuneratively for osier-plantations. The soft-wooded willows like to grow in damper ground than the hard-wooded species. The best peeled willow-branches fetch as much as £25 for the ton. Peeling is best effected by steam, by which means the material is also increased in durability. No basket-willow will thrive in stagnant water.

Osier-plantations in humid places should therefore be drained. The cuttings are best taken from branches one or two years old, and are to be planted as close as 1 foot by 1½ feet. No part of the cutting must remain uncovered, in order that only straight shoots may be obtained; manuring and plowing between the rows is thus also facilitated, after the crop has been gathered, and this, according to the improved Belgian method, must be done by cutting the shoots close to the ground after the fall of the leaves.

Salvia officinalis, L.—The Garden Sage. Countries at the Mediterranean Sea. A somewhat shrubby plant, of medicinal value, pervaded by essential oil. Among nearly half a thousand species of this genus some are gorgeously ornamental.

Sambucus nigra, L.—The ordinary Elder. Europe, North Africa, Middle Asia. The flowers are of medicinal value, and an essential oil can be obtained from them. The wood can be utilized for shoe-pegs and other purposes of artisans. The berries are used for coloring port wine and for other purposes of dye.

Santalum cygnorum, Miquel.—South-western Australia, where this tree yields scented sandal-wood.

Santalum Preissianum, Miq. (*S. acuminatum*, A. de Cand.)—The Quandang. Desert-country of extra-tropical Australia. The fruits of this small tree are called Native Peaches. As both the succulent, outer part, and kernel are edible, it is advisable to raise the plant in desert-tracts, where the species does not occur, since, moreover, it becomes gradually sacrificed on many native places by pasture operations.

Santalum Yasi, Seemann.—The Sandal-tree of the Fiji Islands, where it grows on dry and rocky hills.

It is likely to prove hardy here, and deserves, with a few other species from the South Sea Islands yielding scented wood, test-culture in the warmest parts of our colony.

Saponaria officinalis, L.—The Soapwort or Fuller's Herb. Europe, North and Middle Asia. A perennial herb of some technologic interest, as the root can be employed with advantage in some final processes of washing silk and wool, to which it imparts a peculiar gloss and dazzling whiteness, without injuring, in the least, the most sensitive colors. Experiments, instituted in the laboratory of the Botanic Garden of Melbourne, render it highly probable that Saponin, which produces the froth from the Soapwort, is also present in the bark of *Acacia* (*Albizzia*) *lophantha*, W. At all events, a substance, closely resembling Saponin, was unexpectedly detected (in the course of other investigations intrusted to Mr. Rummel) in the bark of this *Acacia*, and this substance occurred in so large a proportion as to constitute 10 per cent. of the dry bark.

Satureja hortensis, L.—The Summer Savory. Countries around the Mediterranean Sea. An annual scent herb, from which an essential, aromatic oil can be distilled. The culture of this and allied plants is easy in the extreme.

Satureja montana, L. — The Winter Savory. On arid, hilly places at and near the Mediterranean Sea. A perennial, somewhat shrubby herb, frequently used as a culinary condiment along with or in place of the foregoing species, although it is scarcely equal to it in fragrance.

Satureja Thymbra, L. — Countries at or near the

Mediterranean Sea. A small evergreen bush, with the flavor almost of Thyme. The likewise odorous *S. Græca*, L., and *S. Juliana*, L., have been transferred by Bentham to the closely cognate genus *Micromeria*; they are in use since Dioscorides' time, though not representing, as long supposed, the Hyssop of that ancient physician.

Saussurea Lappa, Bentham. (*Haplotaxis Lappa*, De Caisne.) — Cashmere. The aromatic root of this perennial species is of medicinal value, and by some considered to be the *Costus* of the ancients.

Schizostachyum Blumei, Nees. — Java. A lofty Bamboo. A few other species, less elevated, occur in China, the South Sea and Philippine Islands, and Madagascar. The genus might well be united with *Melocanna*. The bamboos being brought once more thus before us, it may be deemed advisable to place together into one brief list all those kinds which are recorded either as very tall or as particularly hardy. Accordingly, from Major General Munro's admirable monography ("Linnean Transact.," 1858) the succeeding enumeration is compiled, and from that masterly essay, resting on very many years' close study of the richest collections, a few prefatory remarks are likewise offered, to vindicate the wish of the writer of seeing these noble and graceful forms of vegetation largely transferred to every part of Australia, where they would impress a grand tropical feature on the landscapes. Even in our far southern latitudes Bamboos from the Indian lowlands have proved to resist our occasional night frosts of the low country. But in colder places the many sub-alpine species could be reared. Be it remembered that *Chusquea aristata*

advances to an elevation of 15,000 feet on the Andes of Quito, indeed, to near the zone of perpetual ice. *Arundinaria falcata*, *A. racemosa*, and *A. spathiflora*, live on the Indian Highlands, at a zone between 10,000 feet and 11,000 feet, where they are annually beaten down by snow. We may further recognize the great importance of these plants when we reflect on their manifest industrial uses, or when we consider their grandeur for picturesque scenery, or when we observe their resistance to storms or heat, or when we watch the marvellous rapidity with which many develop themselves. Their seeds, though generally only in long intervals produced, are valued in many instances higher than rice. The ordinary great Bamboo of India is known to grow 40 feet in 40 days, when bathed in the moist heat of the jungles. The Bourbon Bamboo forms an impenetrable sub-alpine belt, of extraordinary magnificence in yonder island. One of the Tesserim *Bambusas* rises to 150 feet, with a diameter of the mast-like cane sometimes measuring fully one foot. The great West Indian *Arthrostylidium* is sometimes nearly as high, and quite as columnar in its form, while the *Dendrocalamus* at Pulo Geum is equally colossal. The *Platonia* Bamboo, of the highest wooded mountains of Parana, sends forth leaves 15 feet in length, and 1 foot in width. *Arundinaria macrosperma*, as far north as Philadelphia, rises still in favorable spots to a height of nearly forty feet. Through perforating, with artistic care, the huge canes of various bamboos, musical sounds can be melodiously produced, when the air wafts through the groves, and this singular fact may possibly be turned to practice for checking the devastations from birds on many

a cultured spot. Altogether, 20 genera with 170 well-marked species are circumscribed by General Munro's consummate care; but how may these treasures yet be enriched when once the snowy mountains of New Guinea through bamboo jungles become ascended, or when the alps on the sources of the Nile, which Ptolemy and Julius Cæsar already longed to ascend, have become the territory also of phytologic researches, not to speak of many other tropical regions as yet left unexplored. Europe possesses no bamboo; Australia, as far as hitherto ascertained, only one (in the interior of Arnheim's Land). Almost all bamboos are local, and there seems really no exception to the fact that none are indigenous to both hemispheres, all true *Bambusas* being Oriental.

The introduction of these exquisite plants is one of the easiest imaginable, either from seeds or the living roots. The consuls at distant ports, the missionaries, the mercantile and navigating gentlemen abroad, and so particularly also any travelers, could all easily aid in transferring the various bamboos from one country to the other—from hemisphere to hemisphere. Most plants of this kind here with us, once well established in strength under glass, can be trusted out to permanent locations with perfect and lasting safety, at the commencement of the warm season. Indeed, bamboos are hardier than most intra-tropical plants, and the majority of them are not the denizens of the hottest tropical lowlands, but delight in the cooler air of mountain regions. In selecting the following array from General Munro's monography it must be noted that it comprises only a limited number, and that among those which are already to some extent

known, but as yet cannot be defined with precision in their generic and specific relation, evidently some occur which, in elegance, grace and utility, surpass even many of those now specially mentioned :

Arundinaria Japonica, S. and Z.—Japan. Height to 12 feet.

Arundinaria macrosperma, Mich. — North America. Height to 35 feet.

Arundinaria verticillata, Nees. — Brazil. Height to 15 feet.

Arundinaria debilis, Thwaites.—Ceylon; ascends to 8,000 feet. A tall species.

Arundinaria acuminata, Munro. — Mexico. Height to 20 feet.

Arundinaria falcata, Nees. — Himalaya; ascends to 10,000 feet. Height to 20 feet.

Arundinaria tessellata, Munro. — South Africa; ascends to 6,500 feet. Height to 20 feet.

Arundinaria callosa, Munro.—Himalaya; ascends to 6,000 feet. Height to 12 feet.

Arundinaria Khasiana, Munro.—Himalaya; ascends to 6,000 feet. Height to 12 feet.

Arundinaria Hookeriana, Munro.—Sikkim; ascends to 7,000 feet. Height to 15 feet.

Arundinaria suberecta, Munro.—Himalaya; ascends to 4,500 feet. Height to 15 feet.

Thamnocalamus Falconeri, J. Hook. — Himalaya; ascends to 8,000 feet. Tall.

Thamnocalamus spathiflorus, Munro. — Himalaya; ascends to 10,000 feet. Tall.

Phyllostachys bambusoides, S. and Z. — Himalaya, China, Japan. Height to 12 feet.

- Phyllostachys nigra*, Munro.—China, Japan. Height to 25 feet.
- Arthrostylidium longiflorum*, Munro. — Venezuela; ascends to 6,000 feet.
- Arthrostylidium Schomburgkii*, Munro. — Guiana; ascends to 6,000 feet. Height to 60 feet.
- Arthrostylidium excelsum*, Griseb. — West India. Height to 80 feet; diameter 1 foot.
- Arthrostylidium racemiflorum*, Steudel. — Mexico; ascends to 7,500 feet. Height to 30 feet.
- Aulonemia Quexo*, Goudot.—New Granada, Venezuela, in cool regions. Tall, climbing.
- Merostachys ternata*, Nees. — South Brazil. Height to 20 feet.
- Merostachys Claussenii*, Munro.—South Brazil. Height to 80 feet.
- Merostachys Kunthii*, Ruprecht. — South Brazil. Height to 30 feet.
- Chusquea simpliciflora*, Munro. — Panama. Height to 80 feet. Scandent.
- Chusquea abietifolia*, Grisebach.—West India. Tall, scandent.
- Chusquea Culcou*, E. Desv. — Chile. Height to 20 feet. Straight.
- Chusquea uniflora*, Steudel.—Central America. Height to 20 feet.
- Chusquea Galleottiana*, Ruprecht.—Mexico; ascends to 8,000 feet.
- Chusquea montana*, Philippi.—Chile Andes. Height to 10 feet.
- Chusquea Dombeyana*, Kunth. — Peru; ascends to 6,000 feet. Height to 10 feet.
- Chusquea Fendleri*, Munro. — Central America; ascends to 12,000 feet.

- Chusquea scandens*, Kunth.—Colder Central America.
Climbing, tall.
- Chusquea Quila*, Kunth.—Chile. Tall.
- Chusquea tenuiflora*, Philippi.—Chile. Height to 12 feet.
- Chusquea Gaudichaudiana*, Kunth.—South Brazil.
Very tall.
- Chusquea capituliflora*, Trinius.—South Brazil. Very tall.
- Platonia nobilis*, Munro.—New Granada, colder region.
- Nastus Borbonicus*, Gmel.—Bourbon, Sumatra; ascends to 4,000 feet. Height to 50 feet.
- Guadua Tagoara*, Kunth.—South Brazil; ascends to 2,000 feet. Height to 30 feet.
- Guadua latifolia*, Kunth.—Central America. Height to 24 feet.
- Guadua macrostachya*, Rupr.—Guiana to Brazil.
Height to 30 feet.
- Guadua capitata*, Munro.—South Brazil. Height to 20 feet.
- Guadua angustifolia*, Kunth.—Andes of South America. Height to 40 feet.
- Guadua virgata*, Rupr.—South Brazil. Height to 25 feet.
- Guadua refracta*, Munro.—Brazil. Height to 30 feet.
- Guadua paniculata*, Munro.—Brazil. Height to 30 feet.
- Bambusa Tulda*, Roxb.—Bengal to Burmah. Height to 70 feet.
- Bambusa nutans*, Wall.—Himalaya; ascends to 7,000 feet.
- Bambusa tuldoides*, Munro.—China, Hong Kong, Formosa.

- Bambusa pallida*, Munro. — Bengal to Khasia; ascends 3,500 feet. Height to 50 feet.
- Bambusa polymorpha*, Munro.—Burmah, in the Teak region. Height to 80 feet.
- Bambusa Balcooa*, Roxb.—Bengal to Assam. Height to 70 feet.
- Bambusa flexuosa*, Munro. — China. Height to 12 feet.
- Bambusa Blumeana*, Schultes.—Java. Tall.
- Bambusa arundinacea*, Roxb.—S. India. Height to 50 feet.
- Bambusa spinosa*, Roxb.—Bengal to Burmah. Height to 100 feet.
- Bambusa vulgaris*, Wendl.—(B. Thouarsi, K.) Ceylon and other parts of India. Height to 50 feet.
- Bambusa Beecheyana*, Munro.—China. Height to 20 feet.
- Bambusa marginata*, Munro. — Tenasserim; ascends to 5,000 feet. Tall, scandent.
- Bambusa regia*, Th. Thomson.—Tenasserim. Height to 40 feet.
- Bambusa Brandisii*, Munro.—Tenasserim; ascends to 4,000 feet. Height to 120 feet, circumference 2 feet.
- Gigantochloa maxima*, Kurz. (*Bambusa verticillata*, Willd.)—Java. Height to 100 feet.
- Gigantochloa atter*, Kurz.—Java. Height to 40 feet.
- Gigantochloa heterostachya*, Mun.—Malacca. Height to 30 feet.
- Oxytenanthera Abyssinica*, Munro.—Abyssinia to Angola; ascends to 4,000 feet. Height to 50 feet.
- Oxytenanthera nigro-ciliata*, Munro.—Continental and insular India. Height to 40 feet.

- Oxytenanthera albo-ciliata*, Munro. — Pegu, Moulmein.
Tall, scandent.
- Oxytenanthera Thwaitesii*, Munro. (*Dendrocalamus monadelphus*, Thw.)—Ceylon; ascends to 5,000 feet. Height to 12 feet.
- Melocanna bambusoides*, Trin. — Chittagong, Sylhet.
Height to 70 feet.
- Schizostachyum Blumei*, Nees.—Java. Very tall.
- Cephalostachyum capitatum*, Munro.—Himalaya; ascends to 6,000 feet. Height to 30 feet.
- Cephalostachyum pallidum*, Munro.—Himalaya; ascends to 5,000 feet. Tall.
- Cephalostachyum pergracile*, Mun.—Burmah. Height to 40 feet.
- Pseudostachyum polymorphum*, Munro.—Himalaya; ascends to 6,000 feet. Very tall.
- Teinostachyum attenuatum*, Munro. (*Bambusa attenuata*, Thw.)—Ceylon; ascends to 6,000 feet. Height to 25 feet.
- Teinostachyum Griffithi*, Munro.—Burmah. Tall and slender.
- Beesha Travancorica*, Beddome.—Madras. Tall.
- Beesha Rheedei*, Kunth. — Southern India, Cochin-China. Height to 20 feet.
- Beesha stridula*, Munro.—Ceylon.
- Beesha capitata*, Munro.—Madagascar. Height to 50 feet.
- Dendrocalamus strictus*, Nees. — India to Japan.
Height to 100 feet.
- Dendrocalamus sericeus*, Munro.—Behar; ascends to 4,000 feet. Tall.
- Dendrocalamus flagellifer*, Munro.—Malacca. Very tall.

- Dendrocalamus giganteus*, Munro. — Burmah, Penang. Exceedingly tall. Circumference 2 feet.
- Dendrocalamus Hookeri*, Munro. — Himalaya; ascends to 6,000 feet. Height to 50 feet.
- Dendrocalamus Hamiltoni*, Nees. — Himalaya; ascends to 6,000 feet. Height to 60 feet.
- Dinochloa Tjankorreh*, Buehse. — Java, Philippines; ascends to 4,000 feet. Climbing.

Scilla esculenta, Ker. (*Camassia esculenta*, Lindl.) — The Quamash. In the Western extra-tropic parts of North America, on moist prairies. The onion-like bulbs, in a roasted state, form a considerable portion of the vegetable food on which the aboriginal tribes of that part of the globe are living. It is a pretty plant, and might be naturalized here on our moist meadows.

Schœnocaulon officinale, A. Gray. (*Asa-Graya officinalis*, Lindl.) (*Sabadilla officinalis*, Brandt and Dierbach.) — Mountains of Mexico. A bulbous-rooted herb, with leafless stem, thus far specially distinct from any veratrum. It furnishes the sabadilla-seeds, and yields two alkaloids—veratrin and sabadillin; a resinous substance—helonin; also sabadillic and veratric acid. The generic names adopted for this plant by Lindley and by Dierbach are coetaneous.

Scorzonera deliciosa, Gusson.* — Sicily. One of the purple-flowered species, equal if not superior in its culinary use to the allied Salsify.

Scorzonera Hispanica, L.* — Middle and South Europe, Orient. The perennial root of this yellow-flowered herb furnishes not only a wholesome and palatable food, but also serves as a therapeutic remedy, much

like dandelion. Long boiling destroys its medicinal value. Some other kinds of scorzonera may perhaps be drawn into similar use, there being many Asiatic species.

Scorzonera tuberosa, Pallas.—At the Volga and in Syria. Also this species yields an edible root, and so perhaps the Chinese *S. albicaulis*, Bunge, the Persian *Sc. Scowitzii*, Cand., the North African *Sc. undulata*, Vahl., the Greek *Sc. ramosa*, Sibth., the Russian *Sc. Astrachanica*, Cand., the Turkish *Sc. semicana*, Cand., the Iberian *Sc. lanata*, Bieberst. At all events, careful culture may render them valuable esculents.

Sebæa ovata, R. Brown—Extra-tropic Australia and New Zealand. This neat little annual herb can be utilized for its bitter tonic principle (gentian-bitter). *S. albidiflora*, F. v. M., is an allied species from somewhat saline ground. These plants disseminate themselves most readily.

Secale cereale, L.*—The Rye. Orient, but perhaps wild only in the country between the Caspian and Black seas. Mentioned here as the hardiest of all the grain-plants for our highest alpine regions. There are annual and biennial varieties, while a few allied species, hitherto not generally used for fodder or cereal culture, are perennial. The rye, though not so nutritious as wheat, furnishes a most wholesome, well-flavored bread, which keeps for many days, and is most extensively used in Middle and North Europe and Asia. This grain, moreover, can be reared in poor soil and cold climates, where wheat will no longer thrive. In produce of grain rye is not inferior to wheat in colder countries, while the yield of straw is larger, and the culture less exhaustive. It is a hardy

cereal, not readily subject to disease, and can be grown on some kinds of peaty or sandy or moory ground. The sowing must not be effected at a period of much wetness. Wide sand-tracts would be uninhabitable if it was not for the facility to provide human sustenance from this grateful corn. It dislikes moist ground. Sandy soil gives the best grain. It is a very remarkable fact that, since ages, in some tracts of Europe, rye has been prolifically cultivated from year to year, without interruption. In this respect rye stands favorably alone among alimentary plants. It furnishes, in cold countries, also, the earliest green fodder, and the return is large. When the rye-grain becomes attacked by *Cordyceps purpurea*, Fr., or very similar species of fungi, then it becomes dangerously unwholesome; but then also a very important medicinal substance, namely, ergot, is obtained. The biennial Wallachian variety of rye can be mown or depastured prior to the season of its forming grain. In alpine regions Wallachia rye is sown with pine-seeds, for shelter of the pine seedlings in the first year.

Sechium edula, Swartz. — West India. The Chocho, or Chayota. The large root of this climber can be consumed as a culinary vegetable, while the good-sized fruits are also edible. The plant comes, in climates like ours, to perfection.

Selinum anessorrhizum, F. v. M. (*Anessorrhiza Capensis*, Ch. and Schl.) — South Africa. The root of this biennial herb is edible. *A. montana*, Eckl. and Zeyh., a closely allied plant, yields likewise an edible root; and so it is with a few other species of the section *Anessorrhiza*.

Sesamum Indicum, L. — The Gingili. Southern

Asia, extending eastward to Japan. This annual herb is cultivated as far as 42° N. L. The oil, fresh expressed from the seeds, is available for table use. One of the advantages of the culture of this plant consists in its quick return of produce. The soot of the oil is used for China-ink.

Sesbania aculeata, Persoon.—The Danchi. Intra-tropical and sub-tropical Asia, Africa, and Australia. This tall annual plant has proved adapted for our desert regions. It yields a tough fiber for ropes, nets, and cordage, valued at from £30 to £40 for the ton. Several congeneric plants can be equally well utilized.

Shepherdia argentea, Nuttall.—The Buffalo-berry. From the Missouri to Hudson's Bay. This bush bears red, acidulous, edible berries.

Sison Amomum, L.—Middle and South Europe. An herb of one or two years' duration. It grows best on soil rich in lime. The seeds can be used for condiment.

Smilax officinalis, Humboldt. — New Granada and other parts of Central America. This climbing shrub produces at least a portion of the Columbian sarsaparilla.

Smilax medica, Cham. and Schl. — Mexico. This plant produces mainly the sarsaparilla root of that country.

Smilax papyracea, Duhamel. — Guiana to Brazil. The origin of the principal supply of Brazilian sarsaparilla is ascribed to this species, although several others of this genus, largely represented in Brazil, may yield the medicinal root also. In our fern-tree gullies these plants would likely succeed in establishing themselves. *Smilax Australis*, R. Br., extends

from the tropical coast-parts of Australia to East Gipps Land. Neither this nor the East Australian *S. glycyphylla*, Smith, nor the New Zealand *Ripogonum scandens*, Forst., have ever been subjected to accurate therapeutic tests, and the same may be said of numerous other Smilaces, scattered through the warmer countries of the globe. The Italian sarsaparilla, which is derived from the Mediterranean *S. aspera*, L., has been introduced into medicine.

Smyrniolum Olusatrum, L.—The Alisander. Middle and South Europe, North Africa, Western Asia. A biennial herb, which, raw or boiled, can be utilized in the manner of celery. The roots and the fruitlets serve medicinal purposes.

Solanum Æthiopicum, L.—Tropical Africa. Cultivated there and elsewhere on account of its edible berries, which are large, red, globular, and uneven. The plant is annual.

Solanum Dulcamara, L.—Middle and South Europe, North Africa, Middle Asia. A trailing half-shrub, with deciduous leaves. The stems are used in medicine, and contain two alkaloids: Dulcamarin and Solanin.

Solanum edule, Schum. and Thonn.—Guinea. The berry is of the size of an apple, yellow and edible.

Solanum indigoferum, St. Hilaire.—Southern Brazil. A dye-shrub, deserving here trial-culture.

Solanum Gilo, Raddi. — Tropical America; much cultivated there for the sake of its large, spherical, orange-colored berries, which are eatable.

Solanum Lycopersicum, L. (*Lycopersicum esculentum*, L).—The Tomato. South America. Several varieties exist, differing in shape and color of the ber-

ries. It is one of the most eligible plants with esculent fruits for naturalization in our desert country. As is well known, the tomato is adapted for various culinary purposes.

Solanum Melongena, L. (*S. ovigerum*, Dunal; *S. esculentum*, Dunal.)—The Egg-plant. India and some other parts of tropical Asia. A perennial plant, usually renewed in cultivation like an annual. The egg-shaped, large berries are known under the name of Aubergines, or Bringals, or Begoons, as culinary esculents. Allied plants are: *S. insanum*, L., *S. longum*, Roxb., *S. serpentinum*, Desf., *S. undatum*, Lam., *S. ferox*, L., *S. pseudo-saponaceum*, Blume, *S. album*, Lour., which bear all large berries, considered harmless, but may not all represent well-marked species. Absolute ripeness of all such kinds of fruits is an unavoidable requisite, as otherwise even wholesome sorts may prove acrid or even poisonous. Probably many other of the exceedingly numerous species of the genus *Solanum* may be available for good-sized edible berries.

Solanum macrocarpum, L. — Mauritius and Madagascar. A perennial herb. The berries are of the size of an apple, globular, and yellow. *S. Thonningi*, F. Jacq., from Guinea, is a nearly-related plant. *S. calycinum*, Moc. et Sess., from Mexico, is also allied.

Solanum muricatum, l'Herit.—The Pepino of Peru. A shrubby species with egg-shaped, edible berries, which are white with purple spots, and attain a length of 6 inches.

Solanum Quitœense, La Marck.—Ecuador, Peru. A shrubby plant. The berries resemble, in size, color, and taste, small oranges, and are of a peculiar fra-

grance. To this the *S. Plumierii*, Dun., from the West Indian Islands, is also cognate, and the *S. Topiro*, Kunth, from the Orinoco.

Solanum tuberosum, L.*—The Potato. Andes of South America, particularly of Chile, but not absolutely trans-equatorial, as it extends into Columbia. It is also wild in the Argentine territory. As a starch-plant, the potato interests us on this occasion particularly. Considering its prolific yield in our richer soil, we possess, as yet, too few factories for potato-starch. The latter, by being heated with mineral acids or malt, can be converted into Dextrin and Dextro-glucose, for many purposes of the arts. Dextrin, as a substitute for gum, is also obtainable by subjecting potato-starch in a dry state to a heat of 400° F. Alcohol may be largely produced from the tubers. The berries and shoots contain Solanin.

Solanum torvum, Swartz. — From West India to Peru. A shrubby species, with yellow, spherical berries of good size, which seem also wholesome. Other species from tropical America have shown themselves sufficiently hardy for inducing us to recommend the test-culture of such kinds of plants. Many of them are highly curious and ornamental.

Solanum Uporo, Dunal.—In many of the islands of the Pacific Ocean. The large, red, spherical berries of this shrub can be used like the tomato.

Solanum vescum, F. v. Mueller. — The Gunyang. South-east Australia. A shrub yielding edible berries, which need, however, to be fully ripe for securing absence of deleterious properties.

Solanum xanthocarpum, Schrad. and Wendl.—North Africa and South Asia. A perennial herb. The ber-

ries are of the size of a cherry, and either yellow or scarlet.

Sophora Japonica, L.—China and Japan. A deciduous tree. The flowers produce a yellow, or, with admixtures, a green dye, used for silk.

Spartina juncea, Willd. — Salt marshes of North America. A grass with creeping roots; it can be utilized to bind moist sand on the coast. A tough fiber can readily be obtained from the leaves. *S. polystachya*, W. and *S. cynosuroides*, W., are stately grasses, the former also adapted for saline soil, the latter for fresh-water swamps.

Spartium junceum, L.—Countries around the Mediterranean Sea. The flowers of this bush provide a yellow dye. A textile fiber can be separated from the branches.

Spigelia Marylandica, L.—North America, north to Pennsylvania and Wisconsin. A perennial, handsome herb, requiring, as a vermifuge, cautious administration. *S. anthelmia*, L., is an annual plant of tropical America, and possesses similar medicinal properties, in which, probably, other species likewise share.

Spilanthes oleracea, N. Jacq.—The Para Cress. S. America. An annual herb of considerable pungency, used as a medicinal salad.

Spinacia oleracea, L.—Siberia. The ordinary Spinach. An agreeable culinary annual, of rapid growth. It is of a mild, aperient property.

Spinacia tetrandra, Stev.—Caucasus. Also annual and unisexual, like the preceding plant, with which it has equal value, though it is less known.

Stenotaphrum glabrum, Trin.*—South Asia, Africa,

warmer countries of America, not known from any part of Europe or Australia. Here called the Buffalo grass. It is perennial, creeping, and admirably adapted for binding sea-sand and river-banks; also for forming garden-edges, and for establishing a grass-sward on lawns much subjected to traffic; it is, besides, of some pastoral value.

Stilbocarpa polaris, Decaisne and Planchon.—Auckland's and Campbell's islands, and seemingly, also, in the southern extremity of New Zealand. A herbaceous plant with long roots, which are saccharine, and served some wrecked people, for a lengthened period, as sustenance. The plant is recommended here for further attention, as it may prove, through culture, a valuable addition to the stock of culinary vegetables of cold countries.

Stipa tenacissima, L.* (*Macrochloa tenacissima*, Kunth.)—The Esparto or Atocha. Spain, Portugal, Greece, North Africa, ascending the Sierra Nevada to 4,000 feet. This grass has become celebrated since some years, having afforded already a vast quantity of material for British paper-mills. It is tall and perennial, and may prove here a valuable acquisition, inasmuch as it lives on any kind of poor soil, occurring naturally on sand and gravel, as well as on clayey or calcareous or gypseous soil, and even on the very brink of the coast. But possibly the value of grasses of our own, allied to the atocha, may, in a like manner, become commercially established, and, mainly with this view, paper samples of several grass kinds were prepared by the writer (*vide* "Report, Industrial Exhibition, Melbourne, 1867"). Even in the scorching heat and the arid sands of the Sahara, the

atocha maintains itself, and it may thus yet be destined to play an important part in the introduced vegetation of any arid places of our desert-tracts, particularly where lime and gypsum exist. The very tenacious fiber resists decay, and is much employed for the manufacture of ropes. During 1870 the import of esparto ropes into England was 18,500 tons, while the raw material to the extent of 130,000 tons was imported. Extensive culture of this grass has commenced in the south of France. It is pulled once a year, in the earlier part of the Summer. The propagation can be affected from seeds, but is done usually by division of the root. Ten tons of dry esparto, worth from £4 to £5 each, can, under favorable circumstances, be obtained from an acre. The supply has fallen short of the demand. Good writing-paper is made from esparto, without admixture; the process is similar to that for rags, but cleaner. The price of esparto paper ranges from £40 to £50 for the ton. *Stipa arenaria*, Brot., is a closely-allied and still taller species, confined to Spain and Portugal. Consul W. P. Mark deserves great praise for having brought the atocha into commercial and manufactural recognition.

Styrax officinale, L.—Countries on the Mediterranean Sea. A tall bush, or small tree. The fragrant, solid storax-resin exudes from this plant, or is particularly obtained by pressure of the bark.

Symphytum officinale, L.—The Comfrey. Europe, Western Asia. A perennial herb. The root is utilized in veterinary practice. *S. asperrimum*, Sims., from the Caucasus, is recommended by some as a prolific plant for green fodder.

Tacca pinnatifida, G. Forster.—Sand-shores of the

South Sea Islands. From the tubers of this herb the main supply of the Fiji Arrowroot is prepared. It is not unlikely that this plant will endure our coast climate. The Tacca-starch is much valued in medicine, and particularly used in cases of dysentery and diarrhoea. Its characteristics are readily recognized under the microscope. Several other kinds of Tacca are distinguished, but their specific limits are not yet well ascertained. Dr. Seemann admits two (*T. maculata* and *T. Brownii*) for tropical Australia, one of these extending, as a hill-plant, to Fiji. From the leaves and flower-stalks light kinds of bonnets are plaited. A Tacca occurring in the Sandwich Islands yields a large quantity of the so-called arrowroot exported from thence. Other species (including those of *Ataccia*) occur in India, Madagascar, Guinea and Guiana, all deserving tests in reference to their value as starch-plants.

Tamarindus Indica, L.—Tropical Asia and Africa. This magnificent, large, expansive tree extends northward to Egypt, and was found by the writer of this list in North-western Australia. It is indicated here not without hesitation, to suggest new trials of its acclimation on the lower Murray River and in East Gipps Land. The acid pulp of the pods forms the medicinal Tamarind, rich in formic and butyric acid, irrespective of its other contents.

Tanacetum vulgare, L.—The Tansy. North and Middle Europe, North Asia, North-western America. A perennial herb of well-known medicinal value, which mainly depends on its volatile oil.

Telfairia pedata, Hooker.—Mozambique. A cucurbitaceous climber with perennial stems, attaining a

length of 100 feet, with fringed lilac flowers of extraordinary beauty and with fruits attaining a weight of 60 lbs., and containing at times as many as 500 large seeds. The latter, in a boiled state, are eatable, or a large quantity of oil can be pressed from them. The root is fleshy. Our Summers in the Murray country are likely to bring this plant regularly into bearing. A second huge species of similar use, *T. occidentalis*, J. Hook., occurs in Guinea.

Terfezia Leonis, Tulasne. — South Europe, North America. This edible truffle, together with other species of this and other genera, is deserving of naturalization in Australia.

Tetragonia implexicoma, J. Hook. — Extra-tropic Australia, New Zealand, Chatham's Island. A frutescent, widely-expanding plant, forming often large natural festoons, or trailing and climbing over rocks and sand, never away from the coast. As a spinach-plant it is as valuable as the succeeding species. It is well-adapted for the formation of bowers in arid places. *T. trigyna*, Banks and Soland., seems identical.

Tetragonia expansa, Murray.—The New Zealand Spinach, occurring also on many places of the coast and in the desert-interior of Australia. Known also from New Caledonia, China, Japan, and Valdivia. An annual herb, useful as a culinary vegetable, also for binding drift-sand.

Teucrium Marum, L.—Countries at the Mediterranean Sea. A small, somewhat shrubby plant, in use for the sake of its scent, containing a peculiar stearopten. *T. Scordium*, L., from Europe and Middle Asia, *T. Chamædryas*, L., *T. Polium*, L., and *T. Creticum*,

L., from South Europe, are occasionally drawn into medical use. All these, together with many other species from various countries, are pleasantly odorous.

Thea Chinensis, Sims.*—The Tea-shrub of South-eastern Asia. This evergreen and ornamental bush has proved quite hardy in our lowland clime, where, in exposed positions, it endures, without any attention, as well our night-frosts as also the free access of scorching Summer winds. But it is in our humid valleys, with rich alluvial soil and access to springs for irrigation, where only the most productive tea-fields can be formed. The plant comes into plentiful bearing of its product as early as the vine and earlier than the olive. Its culture is surrounded with no difficulties, and it is singularly exempt from diseases, if planted in proper localities. Pruning is effected in the cool season, in order to obtain a large quantity of small, tender leaves from young branches. Both the Chinese and Assam tea are produced by varieties of one single species, the tea-shrub being indigenous in the forest country of Assam. Declivities are best adapted, and usually chosen, for tea-culture, particularly for Congo, Pekoe, and Souchong, while Bohea is often grown in flat countries. For many full details, Fortune's work, "The Tea-Districts of China," might be consulted.

The tea of commerce consists of the young leaves, heated, curled, and sweated. The process of preparing the leaves can be effected by steam machinery; one of particular construction has been suggested recently by Mr. Joachini according to requirements explained by the writer. In 1866, three machines for dressing tea have been patented in England, one

by Messrs. Campbell and Burgess, one by Mr. Thomson, and one by Mr. Tayser. To give an idea of the quantity of tea which is consumed at the present time, it may be stated that, from June to September, 1871, 11,000,000 lbs. of tea were shipped from China alone to Australia, and that the produce of tea in India, from January to June of this year, has been 18,500,000 lbs. Seeds of the tea-bush are now in many parts of this colony locally to be gathered from plants distributed by the writer, and for years to come the cultivation of the tea-bush, merely to secure local supplies of fresh seeds, ready to germinate, will, in all likelihood, prove highly lucrative. Tea contains an alkaloid, coffein, a peculiar essential oil, and bohea-acid, along with other substances.

Thrinax parviflora, Swartz.—West India, and also on the continent of Central America. The stem of this fan-palm attains a height of 25 feet. It belongs to the sand-tracts of the coast and may endure our climate. The fiber of this palm forms material for ropes. *T. argentea*, Lodd., is a closely-allied palm. The few other species of the genus deserve also trial-culture here.

Thymelæa tinctoria, Endl. (*Passerina tinctoria*, Pourr.)—Portugal, Spain, South France. A small shrub. It yields a yellow dye. Cursorily it may be noted here that some of our pimeleæ contain a blue pigment, which has not yet been fully tested. Their bark produces more or less of daphnin, and of the volatile acrid principle for which the bark of *Daphne Mezereum*, L., is used. These are remarkably developed in the Victorian *Pimelea stricta*, Meissn. The bark of many is also pervaded by a tough fiber, that

of the tall *Pimelea clavata*, Labill., a West Australian bush, being particularly tenacious.

Thymus capitatus, Hoffm. and Link. (*Satureja capitata*, L.)—Around the whole Mediterranean Sea. Since the times of Hippocrates, Theophrastos, and Galenus this small, scented shrub has been employed in medicine.

Thymus Mastichina, L.—Spain, Portugal, Morocco. A half shrub of agreeable scent, used also occasionally in medicine.

Thymus Serpillum, L. — Europe, Western Asia. A perennial herb of some medicinal value. It would live on our highest alps. An essential oil can be obtained from it. One particular variety is lemon-scented.

Thymus vulgaris, L.—The Garden-Thyme. South Europe. This small, shrubby plant is available for scent and for condiments. It is also well adapted for forming garden-edges. The essential oil of this plant can be separated into the crystalline thymol and the liquid thymen and cymol. *T. Æstivus*, Reut., and *T. hiemalis*, Lange, are closely cognate plants. Several other species with aromatic scent occur at the Mediterranean Sea.

Tragopogon porrifolius, L. — The Salsify. Middle and Southern Europe, Middle Asia. The root of this herb is well known as a useful culinary vegetable.

Trapa bicornis, L. fl.*—The Leng or Ling or Links of China. The nuts of this water-plant are extensively brought to market in that country. The horns of the fruit are blunt. The kernel, like that of the two following species, is of excellent taste. The plant is regularly cultivated in lakes and ponds of China.

Trapa bispinosa, Roxb.*—Middle and South Asia, extending to Ceylon and Japan; found also in Africa as far south as the Zambesi. Here, in our culture, it lasts through several years. In some countries, for instance in Cashmere, the nuts form an important staple of food to the population. To this species probably belong *T. Cochinchinensis*, Lour., and *T. incisa*, Sieb. and Zucc.

Trapa natans, L.*—The ordinary Waternut. Middle and South Europe, Middle Asia, North and Central Africa. Recorded as an annual. *T. quadrispinosa*, Roxb., from Sylhet, is an allied plant.

Trifolium agrarium, L. — The perennial Yellow Clover or Hop Clover. All Europe, Western Asia. Of considerable value in sandy soil as a fodder-herb. It is easily naturalized.

Trifolium Alexandrinum, L.*—The Bersin Clover. North-eastern Africa, South-western Asia, South Europe. Much grown for forage in Egypt. Recorded as annual.

Trifolium fragiferum, L.—The Strawberry Clover. Europe, North Africa, Middle and North Asia. A perennial species, well adapted for clayey soils.

Trifolium hybridum, L.*—The Alsike Clover. Europe, North Africa, Western Asia. A valuable, perennial pasture herb, particularly for swampy localities.

Trifolium incarnatum, L. — The Carnation Clover. Middle and South Europe. Though annual only, it is valued in some of the systems of rotation of crops. It forms particularly a good fodder for sheep. A white-flowering variety exists.

Trifolium medium, L.* — The Red, Zigzag Clover.

Europe, North and Middle Asia. A deep-rooting, perennial herb, much better adapted for dry, sandy places than *T. pratense*. It would also endure the inclemency of the climate of our higher alpine regions if disseminated there. *T. Quartinianum*, A. Rich., is an allied plant from Abyssinia, where several endemic species exist.

Trifolium pratense, L.—The ordinary Red Clover. All Europe, North Africa, North and Middle Asia, extending to Japan. A biennial, or, under special circumstances, also perennial herb, of great importance for stable-fodder. It prefers rich soil, and particularly that which is not devoid of lime. Also this species would live in our alps, where it would much enrich the pastures.

Trifolium repens, L.*—The ordinary White Clover. Europe, North Africa, North and Middle Asia, subarctic America. Perennial. Most valuable as a fodder-plant on pastoral land. It has a predilection for moist soil, but springs again from dry spots after rain. It has naturally spread over many of our humid valleys, and its growth should be encouraged in such localities.

Trifolium subrotundum, Hochstett. — The Mayad Clover. North and Middle Africa, ascending to 9,000 feet. A perennial species; in its native countries with advantage utilized for clover culture. This by no means closes the list of the clovers desirable for introduction, inasmuch as about 150 well-marked species are recognized, many, doubtless, of pastoral value. But the notes of rural observers on any of these kinds are so sparingly extant that much uncertainty about the yield and nutritive value of the various kinds con-

tinues to prevail. Most clovers come from the temperate zone of Europe and Asia ; only two are indigenous to eastern parts of the United States of North America, none occur in Australia, few are found in South Africa, several in California and the adjoining countries, several also in Chile ; no species is peculiar to Japan.

Trigonella Fœnum Græcum, L.—Countries on the Mediterranean Sea. The seeds of this annual herb find their use in veterinary medicine.

Trigonella suavissima, Lindley.—Interior of Australia, from the Murray River and its tributaries to the vicinity of Shark's Bay. This perennial, fragrant, clover-like plant proved a good pasture-herb. A lithogram illustrating this plant occurs in the work on the "Plants Indigenous to Victoria." Some of the many European, Asian, and African plants of this genus deserve our local tests.

Tripsacum dactyloides, L. — Central and North America. A reedy, perennial grass, more ornamental than utilitarian. It is the original Buffalo-grass, and attains a height of 7 feet, assuming the aspect of maize. It is of inferior value for fodder.

Triticum vulgare, Villars.* — The Wheat. Apparently risen through culture from *Ægilops ovata*, L., and then a South European, North African, and Oriental plant. This is not the place to enter into details about a plant universally known. It may therefore suffice merely to mention that three primary varieties must be distinguished between the very numerous sorts of cultivated wheat: 1. *Var. muticum* (*T. hybernum*, L.), the Winter Wheat or Unbearded Wheat ; 2. *Var. aristatum* (*T. æstivum*, L.), the Sum-

mer Wheat, or Bearded Wheat; 3. Var. *adhærens* (T. *Spelta*, L.), Wheat with fragile axis and adherent grain. Metzger enumerates as distinct kinds of cultivated wheat:

- T. *vulgare*, Vill., which includes, among other varieties, the ordinary Spring Wheat, the Fox Wheat and the Kentish Wheat. It comprises also the best Italian sorts for plaiting straw-bonnets and straw-hats, for which only the upper part of the stem is used, collected before the ripening of the grain, and bleached through exposure to the sun while kept moistened.
- T. *turgidum*, L., comprising some varieties of White and Red Wheat, also the Clock Wheat and the Revet Wheat.
- T. *durum*, Desfont., which contains some sorts of the Bearded Wheat.
- T. *Polonicum*, L., the Polish Wheat, some kind of which is well adapted for Peeled Wheat.
- T. *Spelta*, L., the Spelt Corn or Dinkel Wheat, a kind not readily subject to disease, succeeding on soil of very limited fertility, not easily attacked by birds, furnishing a flour of excellence for cakes, also yielding a superior grain for Peeled Wheat. For preparing the latter it is necessary to collect the spikes while yet somewhat green and to dry them in baking-houses.
- T. *diccicum*, Schrank. (T. *amyleum*, Ser.) — The Emmer Wheat. Its varieties are content and prolific on poor soil, produce excellent starch, are mostly hardy in frost and not subject to diseases. To this belongs the Arras Wheat of Abyssinia, where a few other peculiar sorts of wheat are to be found.

T. monococcum, L.—St. Peter's Corn, which is harder than most other wheats; exists in the poorest soils, but produces grains less adapted for flour than Peeled Wheat.

Tropæolum majus, L.—Peru. This showy, perennial climber passes with impropriety under the name of Nasturtium. The herbage and flowers serve as Cress and also are considered anti-scorbutic. A smaller species, *T. minus*, L., also from Peru, can likewise be chosen for a Cress-salad; both besides furnish, in their flower-buds and young fruits, a substitute for capers. A volatile oil of burning taste can be distilled from the foliage of both; and this is more acrid even than the distilled oil of mustard-seeds. In colder countries these plants are only of one year's duration. Numerous other species, all highly ornamental, occur in South America, and a few also in Mexico.

Trophis Americana, L.—West Indian Archipelagus. The foliage of this milky tree has been recommended as food for the silk-insect. In Cuba and Jamaica it is used as provender for cattle and sheep.

Tuber æstivum, Vittad.—The Truffle mostly in the markets of England. The white British Truffle, *Chairomyces meandriformis*, Vitt., though large, is valued less. In the Department Vaucluse (France) alone, about 60,000 lbs. of truffles are collected annually, at a value of about £4,000. Many other kinds of truffles are in use. Our own native truffle, *Mylitta australis*, Berk., attains, sometimes, the size of a cocoonut, and is also a fair esculent. It seems also quite feasible to naturalize the best of edible fungi of other genera, although such may not be amenable to regular culture,

Tuber cibarium, Sibthorp. —Middle and South Europe. The Black Truffle. Like all others, growing under ground, and generally found in forest-soil of limestone formation. It attains a weight over one pound. Experiments for naturalization may be effected, with every prospect of success, by conveying the truffle in its native soil to us, and locating it in calcareous places of our forest-regions. As a condiment, or merely in a roasted state, it affords an aromatic food. *T. melanosporum*, Vitt., from France, Germany, and Italy, is of a still more exquisite taste than *T. cibarium*, indeed of strawberry flavor. Again, *T. magnatum*, Pico, from Italy, is of delicious fragrance.

Ullucus tuberosus, Lozano. (*Melloca tuberosa*, Lindl.)—Andes of New Granada and Peru, up to an elevation of 9,000 feet. A perennial herb, the tubers of which are edible.

Urginia Scilla, Steinheil. (*Scilla maritima*, L.)—South Europe, North Africa. The medicinal Squill. The plant needs not regular cultivation, but settlers living near the coast might encourage its dissemination, and thus obtain the bulbs as a drug from natural localities. Its peculiar bitter principle is called Scillitin.

Uvularia sessilifolia, L.—North America, in forests. This pretty herb is mentioned as yielding a good substitute for asparagus.

Vaccinium alatum, Dombey. (*Thibaudia alata*, Dunal.)—Frigid regions of the Andes of Peru. A tall, evergreen shrub, with pink berries of the size of a cherry. This highly-ornamental plant could be grown in our sub-alpine regions.

Vaccinium bicolor, F. v. M. (*Thibaudia bicolor*,

R. and P.)—Cold zone of the Peruvian Andes. A high, evergreen bush, with red berries of the size of a hazel-nut. All *Thibaudias* seem best to form a section in the genus *Vaccinium*, some species of the latter, for instance *Vaccinium Imrayi*, Hook., from Dominica, mediating the transit. The species of the section *Thibaudia* are, as a rule, producing red berries of acidulous, grateful taste. Many others may deserve, therefore, culture in our forest-ravines or on our alpine heights. They occur from Peru to Mexico, also in West India. One species, *Vaccinium melliflorum* (*Thibaudia melliflora*, R. and P.), has its flowers rich in honey-nectar.

Vaccinium cæspitosum, Mich.—Canada and Northern States of North America. A deciduous-leaved small bush, with blueish, edible berries. *V. ovalifolium*, Sm., is an allied species.

Vaccinium corymbosum, L.*—The Swamp Blueberry or blue Huckleberry. Canada and United States of North America. A good-sized shrub with deciduous foliage. Berries blueish-black, of sweetish taste, ripening late in the season.

Vaccinium erythrocarpum, Michaux.—(*Oxycoccus erectus*, Pursh.)—Carolina and Virginia, on high mountains. An upright bush of a few feet in height, with deciduous leaves. The transparent scarlet berries, according to Pursh, are of excellent taste.

Vaccinium grandiflorum, Dombey. (*Ceratostemma grandiflorum*, R. and P.)—Andes of Peru. A tall, evergreen shrub. The berries of a pleasant, acidulous taste.

Vaccinium humifusum, Graham.—North-western America, on the Rocky Mountains. Berries of this bush well flavored.

Vaccinium Leschenaultii, Wight. (*Agapetes arborea*, Dunal.) — India, Neilgherries and Ceylon. This evergreen species attains the size of a tree, flowering and fruiting throughout the year. The fruit resembles cranberries.

Vaccinium leucanthum, Cham. — Mountains of Mexico. An arborescent species. The blackish berries are edible.

Vaccinium macrocarpon, Aiton.* (*Oxycoccus macrocarpus*, Pers.) — The large Cranberry. From Canada to Virginia and Carolina, particularly in sandy and peaty bogs, and in cold, mossy swamps. A trailing, evergreen bush, with stems attaining a length of 3 feet. It is this species which has become so extensively cultivated in the eastern parts of the United States, where, on moory land, often not otherwise to be utilized, enormous quantities of this fruit have been produced by regular culture, on a highly profitable scale. The berries are of the acid taste, pleasant aroma and scarlet brightness of the British Cranberry, but considerably larger.

Vaccinium meridionale, Swartz. — Jamaica, from the summits of the highest ranges down to the coffee-regions. It attains a height of 30 feet, and is evergreen. The small berries are of the taste and color of those of *V. Vitis Indæa*.

Vaccinium Mortinia, Bentham. — Mountains of Columbia. A shrub several feet high. The fruits resemble those of *V. myrtillus*, but are more acid. They come under the name *Mortina* to the Quito market.

Vaccinium myrtillus, L.* — The British Whortleberry, or Bilberry. Throughout Europe, North and Middle Asia, remotest North America, in heathy and

turfy forest-land. A shrub, a few feet high or less, deciduous, erect, of great value for its copious supply of berries. They are, as well-known, black, with a blueish-gray hue and of exceedingly grateful taste. The naturalization of this plant on our alpine ranges and in our cooler woodlands, particularly in our forests of *Fagus Cunninghami*, would prove a boon. The berries can be utilized for their dye. The whole bush contains Quina acid.

Vaccinium myrtilloides, Michaux.—Michigan, Canada, Newfoundland, Labrador. The large, edible berries are called Bluets. This little bush is adapted for our higher alpine country.

Vaccinium Oxycoccus, L.* (*Oxycoccus palustris*, Pers.) — The British Cranberry. Through Europe, North and Middle Asia, North America, on turf-moss in moory heaths. A creeping, evergreen shrub of particular neatness. The berries give a most agreeable preserve and are of anti-scorbutic value. This species is particularly eligible for the spongy, mossy bogs of our snowy mountains.

Vaccinium parvifolium, Smith. — North-western America. A tall shrub. The berries are excellent for preserves.

Vaccinium Pennsylvanicum, Lamarek.* (*V. angustifolium*, Aiton.) — The early Blueberry or Blue Huckleberry. North America, on dry, woody hills. A dwarf-bush, with deciduous foliage, producing fruit in abundance. The berries are large, blueish-black, and of sweet taste. *V. Canadense*, Kalm, according to Dr. Asa Gray, is closely allied.

Vaccinium uliginosum, L.—British Bog Bilberry. Europe, North and Middle Asia, North America. A

deciduous bush, with blackish berries, similar to those of *V. myrtillus*, but hardly of equal excellence.

Vaccinium vacillans, Solander. — North America, in sandy forest-lands. A deciduous, small bush, coming with its blue berries later into season than *V. Pennsylvanicum*.

Vaccinium Vitas Indæa, L. — Europe, North and Middle Asia, North America. A dwarf-shrub with evergreen leaves. The purplish-red berries are sought for jellies and other preserves.

It is as yet impossible to say how many other species of *Vaccinium* are producing good-sized and well-flavored fruits. But the genus ranges, in many species, from Continental Asia to the Indian Archipelagus, and has a wide extension also in South America, occupying, in hot countries, higher mountain regions. But few reliable notes on the tropical species are extant, as far as the fruits are concerned.

Valeriana Celtica, L. — Alps of Europe. The root of this perennial herb is particularly aromatic.

Valeriana edulis, Nuttall. — North-western America, from Oregon to the Rocky Mountains. The thick, spindle-shaped root of this herb affords food to the natives of that part of the globe. When baked the root proves agreeable and wholesome. When we consider the wild states of the plant, from which many of our important root-crops arose, then this *Valeriana* and several other plants, suggestively mentioned in these pages, may well be admitted for trial culture.

Valeriana officinalis, L. — Europe, North and Middle Asia, in swampy grass-land, with a predilection for forests and river-banks. This perennial herb would do particularly well on our alps. It is the only

one among numerous congeners of Europe, Asia, and America, which is drawn to a considerable extent into medicinal use. The root and herb contain Valerianic acid and a peculiar tannic acid ; the root furnishes an essential oil, which again resolves itself into Valerol (70 per cent.), Valereen, Barneol, and Valerianic acid. The order of Valerianæ is not represented by any native plant in Australia.

Valerianella olitoria, Moench. — Lamb's Lettuce. Europe, North Africa, North and Middle Asia. A fair and early salad plant. It is an annual plant, and has several congeners in Europe and Asia.

Veratrum album, L.—Europe, North and Middle Asia, extending eastward to Japan. It delights particularly in sub-alpine localities. The root furnishes Veratrin, Jervin, and Sabadillie acid.

Veratrum viride, Aiton.—Canada and United States of North America. A near relative of the former plant. Its root has come recently into medicinal use.

Vicia Ervilia, Willdenow. (*Ervum Ervilia*, L.)—South Europe, North Africa, South - western Asia. An annual herb, praised as a valuable fodder-plant on dry, calcareous soil.

Vicia Faba, L.*—The Straight Bean. Orient, particularly on the Caspian Sea. This productive, annual herb affords not only its seeds for table use, but provides also a particularly fattening table food. The seeds contain about 33 per cent. starch.

Vicia sativa, L.* (*V. angustifolia*, Roth.)—The ordinary Vetch or Tare. Europe, North Africa, North and Middle Asia. One of the best of fodder-plants, but only of one or two years' duration. Many of the

other European and Asiatic species of *Vicia* are deserving our attention.

Vigna Sinensis, Endl.* (*Dolichos Sinensis*, L.)—Tropical Asia and Africa. The cultivation of this twining, annual, pulse-herb extends to Southern Europe and many other countries with a clime like ours. The pods are remarkable for their great length, and used like French beans. *Vigna Catjang*, A. Rich., and *Vigna sesquipedalis* are varieties of this species. In fair soil the produce is forty-fold.

Viola odorata, L.—The Violet. Middle and South Europe, North Africa, Middle Asia. Passingly alluded to here, as this modest, though lovely plant should be extensively naturalized in our forest-glens, to furnish its delicate scent for various compositions of perfumery.

Vitis acetosa, F. v. Mueller.—*Carpentaria* and *Arnheim's Land*. Stems rather herbaceous than shrubby, erect. The whole plant is pervaded with acidity, and proved valuable in cases of scurvy. The berries are edible. This species, if planted here, would likely spring annually afresh from the root.

Vitis æstivalis, Michaux.*—The Summer Grape of the United States of North America. Flowers fragrant. The berries are deep blue, of pleasant taste, and ripen late in the season.

Vitis Baudiniana, F. v. Mueller. (*Cissus Antarctica*, Vent.)—East Australia. With *V. hypoglauca*, the most southern of all grapes, none extending to New Zealand. It is evergreen, and here a vigorous plant for bowers, but suffers even from slight frosts. The berries are freely-produced and edible, though not large.

Vitis cordifolia, Michaux.* (*Vitis riparia*, Mich.)
—The Winter Grape or Frost Grape. From Canada to Florida. A deciduous vine. The scent of the flowers reminds of Reseda. The berries are small, either blackish or amber-colored, and very acid. They can be used for preserves, and are only fully-matured when touched by frosts. A succession of seedlings may give us a superior and simultaneously a very hardy vine.

Vitis hypoglauca, F. v. Mueller. — East Australia, as far south as Gipps Land. An evergreen climber of enormous length, forming a very stout stem in age. The black berries attain the size of small cherries. Also this species may perhaps be vastly changed in its fruit by continued culture.

Vitis Indica, L.—On the mountains of various parts of India, ascending an altitude of 3,000 feet in Ceylon. The small berries are edible. The plant should be subjected to horticultural experiments. This is an apt opportunity to draw attention to the various Indian species of *Vitis*, with large, edible berries; for instance: *V. lægiovata*, Bl., *V. thyrsiflora*, Miq., *V. mutabilis*, Bl., *V. Blumeana*, Steud., all from the mountains of Java, and all producing berries as large as cherries, those of *V. Blumeana* being particularly sweet. Further, may here be inserted *V. imperialis*, Miquel, from Borneo, *V. auriculata*, Wall., and *V. elongata*, Wallich, both the last from the mountainous mainland of Coromandel, and all producing very large juicy berries even in the jungle wilderness. *V. quadrangularis*, L., stretches from Arabia to India and Central Africa, and has also edible fruits. Many such plants may be far more eligible for grape-culture in

hot, wet, climes than the ordinary vine. About 250 species of *Vitis* are already known, mostly from intra-tropical latitudes, and mostly evergreen; but in regard to their elevation above the ocean, and to the nature of their fruits, we are almost utterly without data.

Vitis Labrusca, L.*—The Isabella Grape. North America, from Canada to Texas and Florida, also in Japan. The Schuylkill Grape is derived from this species. A pale-fruited variety furnishes the Bland's Grape. Another yields the American Alexander Grape. The berries are large among American kinds and are of pleasant taste. Flowers fragrant. This and the other hardy North American vines seem never to be attacked by the oidium disease.

Vitis Schimperiana, Hochstetter.—From Abyssinia to Guinea. This vine may become valuable with many other Central African kinds for tropical culture, and may show itself hardy here. Barter compares the edible berries to clusters of Frontignac grape.

Vitis vinifera, L.* — The Grape Vine. Turkey, Persia, Tartary. This is not the place to discuss at length the great industrial questions concerning this highly important plant, even had these not engaged already since many years the attention of a large number of our colonists. The whole territory of Victoria stretches essentially through the vine-zone, and thus most kinds of vines can be produced here, either on the lowlands or the less elevated mountains in various climatic regions, and in different geologic formations.

The Corinthian variety, producing the "Currants" of commerce, thrives also well in some districts, where, with Raisins, it promises to become a staple article

of our exports beyond home consumption. Dr. W. Hamm, of Vienna, has recently issued a vine map of Europe, indicating the distribution of the different varieties and the principle sources of the various sorts of wine. The writer would now merely add that the preservation of the grapes in a fresh state, according to M. Charmeux's method, and the sundry modes of effecting the transit of ripe grapes to long distances, ought to be turned to industrial advantage. The pigment of the dark wine-berries is known as Oenolic acid. The juice contains, along with Tartaric acid, also Grape acid. All these chemically-defined substances have uses of their own in art and science.

Vitis vulpina, L.* (*Vitis rotundifolia*, Mich.) — The Muscadine or Fox Grape. South-eastern States of North America. This species includes as varieties also the Bullace, the Mustang, the Bullet Grape, both kinds of the Scuppernangs, and the Catawba Grape. The berries are of a pleasant taste, but, in some instances, of a strong flavor; they are the largest among American grapes.

Voandzeia subterranea, Thouars.—Madagascar and various parts of Africa, as far south as Natal. This Earth Pea is annual, and pushes its pods under ground in the manner of *Arachis hypogæa* for maturation. The pods are edible, and much consumed in tropical countries.

Wallichia oblongifolia, Griffith.—Himalaya, as far as 27° north. There one of the hardiest of all palms. It is not a tall one, yet a graceful and useful object for cultural industries. Several species exist.

Wettinia augusta, Poeppig. — Peru, on mountains several thousand feet high. This palm is therefore likely to endure our clime.

Wettinia Maynensis, Spruce.—Cordilleras of Peru. Like the foregoing, it attains a height of 40 feet, and advances to elevations of 3,000 feet or 4,000 feet. Before finally parting from the American palms it may be appropriate to allude briefly to some of the hardier kinds, which were left unnoticed in the course of this compilation. From Dr. Spruce's important essay on the palms of the Amazon River may be learned that, besides other species as yet imperfectly known from the sources of this great river, the following kinds are comparatively hardy; thus they might find places for cultivation, or even naturalization, within the limits of our colony: *Geonema undata*, Klotzsch; *Iriartea deltoidea*, R. and P.; *Iriartea ventricosa*, Mart., which latter rises in its magnificence to fully 100 feet; *Iriartea exorrhiza*, Mart.; this, with the two other *Iriarteas*, ascends the Andes to 5,000 feet. *Cenocarpus multicaulis*, Spruce, ascends to 4,000 feet; from 6 to 10 stems are developed from the same root, each from 15 to 30 feet high. *Euterpe*; of this two species occur in a zone between 3,000 feet and 6,000 feet.—*Phytelephas microcarpa*, R. and P.; eastern slope of the Peru Andes, ascending to 3,000 feet. *Phytelephas macrocarpa*, R. and P.; also on the eastern side of the Andes, up to 4,000 feet; it is this superb species which yields by its seeds part of the vegetable ivory. *Phytelephas æquatorialis*, Spruce; on the west slope of the Peruvian Andes, up to 5,000 feet; this palm is one of the grandest objects in the whole vegetable creation, its leaves attaining a length of 30 feet! The stem rises to 20 feet. Palm-ivory is also largely secured from this plant. Though æquinoctial it lives only in the milder regions of the

mountains; therefore in the equable temperature of East Gipps Land it would likely prosper without protective cover. *Carludovica palmata*, R. and P.; on the east side of the Andes of Peru and Ecuador, up to 4,000 feet; the fan-shaped leaves from cultivated specimens furnish the main material for the best Panama hats. The illustrious Count de Castelnau saw many palms on the borders of Paraguay during his great Brazilian expedition. Most of these, together with the palms of Uruguay and the wide Argentine territory, would likely prove adapted for acclimation in our latitudes; but hitherto the limited access to these countries has left us largely unacquainted with its vegetable treasures also in this direction. Von Martius demonstrated, already in 1850, the occurrence of the following palms in extra-tropic South America: *Ceroxylon australe*, Mart., on high mountains in Juan Fernandez, at 30° S. L.; *Jubæa spectabilis*, Humb., in Chile, at 40° S. L.; *Trithrinax Brasiliana*, Mart.; at 31° S. L.; *Copernicia cerifera*, Mart., at 29° S. L.; *Acrocomia Totai*, Mart., at 28° S. L.; *Cocos Australis*, Mart., at 34° S. L.; *Cocos Yatai*, Mart., at 32° S. L.; *Cocos Romanzoffiana*, Cham., at 28° S. L.; *Diplothemium littorale*, Mart., at 30° S. L. All the last mentioned palms occur in Brazil, the *Acrocomia* and *Trithrinax* extending to Paraguay, and *Cocos Australis* to Uruguay and the La Plata State.

While some palms, as indicated, descend to cooler latitudes, others ascend to temperate and even cold mountain regions. Among the American species are prominent in this respect: *Euterpe andicola*, Brogn., *E. Hænkeana*, Brogn., *E. longivaginata*, Mart., *Diplothemium Porallyi*, Mart., and *Ceroxylon pithyro-*

phyllum, Mart., all occurring on the Bolivian Andes at an elevation of about 8,000 feet—*Ceroxylon andicola*, Humb., *Kunthia montana*, Humb., *Oreodoxa frigida*, Humb., and *Geonoma densa*, Linden, reach also on the Andes of New Granada a height of, at least, 8,000 feet—*Ceroxylon Klopstockia*, Mart., advances on the Andes of Venezuela to a zone 7,500 feet altitude, where Karsten saw stems 200 feet high with leaves 24 feet long! There also occur *Syagrus Sancona*, Karst., and *Platenia Chiragua*, Karst., at elevations of 5,000 feet, both very lofty palms. From the temperate mountain regions of sub-tropical Mexico are known among others: *Chamædora concolor*, Mart., *Copernicia Pumos*, Humb., *C. nana*, Kunth, and *Brahea dulcis*, Mart., at elevations from 7,000 feet to 8,000 feet.

Xanthorrhiza apiifolia, l'Herit.—North America. A perennial, almost shrubby plant, of medicinal value. The root produces a yellow pigment, similar to that of *Hydrastis Canadensis*, L. Both contain also Berberin.

Ximenia Americana, L.—Tropical Asia, Africa, and America, passing, however, the tropics in Queensland, and gaining also an indigenous position in Florida. This bush may, therefore, accommodate itself to our climate in localities free of frost. The fruits are edible, resembling yellow plums in appearance; their taste is agreeable. The wood is scented.

Yucca filamentosa, L.—The Adam's Needle. From Carolina and Florida to Texas and Mexico. An almost stemless species. It would hardly be right to omit here the plants of this genus altogether, as they furnish a fiber of great strength, similar to that of the

Agaves. Moreover, all these plants are decorative, and live in the poorest soil, even in drifting coast-sand. They are also not hurt, as in the case with the Fourcroyas, by the frosts of our lowlands. Among the species with stems of several feet in height may be recorded *Y. gloriosa*, L., and *Y. aloifolia*, L., both from the sandy south coast of North America.

Zalacca secunda, Griffith.—Assam, as far north as 28°. A stemless palm, with large, feathery leaves, exquisitely adapted for decorative purposes. Before we finally quit the Asiatic palms we may yet learn, from Von Martius's great work, how many extra-tropic members of this princely order were known in 1850 already, when that masterly work was concluded. Martius enumerated as belonging to the boreal extra-tropic zone in Asia: from Silhet, at 24° N. L.: *Calamus erectus*, Roxb.; *C. extensus*, Roxb.; *C. quinquenervius*, Roxb.;—from Garo, at 26° N. L.: *Wallichia caryotoides*, Roxb.; *Ptychosperma gracilis*, Miq.; *Caryota urens*, L.; *Calamus leptospadix*, Griff.;—from Khrsyra, in 26° N. L.: *Calamus acanthospathus*, Griff.; *C. macrospathus*, Griff.; *Plectocomia Khasyana*, Griff.;—from Assam, about 27° N. L.: *Areca Nagensis*, Griff.; *A. triandra*, Roxb.; *Livistona Jenkinsii*, Griff.; *Dæmonorops nutantiflorus*, Griff.; *D. Jenkinsii*, Griff.; *D. Guruba*, Mart.; *Plectocomia Assamica*, Griff.; *Calamus tenuis*, Roxb.; *C. Flagellum*, Griff.; *C. heliotropium*, Hamilt.; *C. floribundus*, Griff.; *Phœnix Ouseloyana*, Griff.;—from Upper Assam, between 28° and 29° N. L.: *Caryota obtusa*, Griff.; *Zalacca secunda*, Griff.; *Calamus Mishmelenis*, Griff.;—from Darjiling, at 27° N. L.: *Wallichia obtusifolia*, Griff.; *Licuala peltata*, Roxb.; *Plectoco-*

mia Himalayana, Griff. ; *Calamus schizospathus*, Griff. ;
 —from Nepaul, between 28° and 29° N. L. : *Chamærops*
Martiana, Wall. ; —from Guhrval, in 30° N. L. :
Calamus Royleanus, Griff. ; —from Saharampoor, in
 30° N. L. : *Borassus flabelliformis*, L. ; —from Duab,
 in 31° N. L. : *Phoenix silvestris*, Roxb. ; —from Khe-
 ree, in 30° N. L. : *Phoenix numilis*, Royle ; —from
 Deccan : *Bentinckia Coddapanna*, Berry, at an eleva-
 tion of 4,000 feet.

Miquel mentions as palms of Japan (entirely extra-
 tropical) : *Rhapis flabelliformis*, Aiton ; *R. humilis*,
 Blume ; *Chamærops excelsa*, Thunb. ; *Livistona Chi-*
nenensis, Br., and *Arenga saccharifera*, La Bill., or a
 species closely allied to that palm.

Zea Mays, L.*.—The Maize, or Indian Corn. In-
 digenous to the warmer parts of South America. St.
 Hilaire mentions it as a native of Paraguay. Found in
 Central America already by Columbus. This conspic-
 uous though annual cereal grass interests us on this
 occasion as being applicable here to far more uses
 than those for which it has hitherto been employed.
 In North America, for instance, maize is converted
 into a variety of dishes for the daily table, being thus
 boiled in an immature state as “green corn.” Mixed
 with other flour it furnishes good bread. For some
 kind of cakes it is solely used, also for maizena mac-
 caroni and Polenta. Several varieties exist; the
 Inca-maize, of Peru, being remarkable for its gigan-
 tic size and large grains. Maize is not readily sub-
 ject to the ordinary corn diseases ; but, to prosper, it
 requires fair access to potash and lime. Good writing
 and printing papers can be prepared from maize-straw.
 Meyen calculated that the return from maize, under

most favorable circumstances in tropical countries, would be 800-fold, and, under almost any circumstances, it is the largest yielder among cereals in warm countries. As a fattening, saccharine green-fodder maize is justly appreciated. Any ergot from it is used, like that of rye, for medicinal purposes. Maize-corn contains about 75 per cent. of starch. Dierbach recommends mellago or treacle from maize, instead of that prepared from the roots of *Triticum repens*, L., and the molasses so obtained serves also culinary uses.

Zingiber officinale, Roscoe. — The Ginger. India and China. Possibly this plant may be productive in the hottest parts of our colony, and give satisfactory results. The multiplication is effected by division of the root. For candied ginger only the young, succulent roots are used, which are peeled and scalded prior to immersion into the saccharine liquid.

Zizania aquatica, L.* (*Hydropyrum esculentum*, Link.) — The Canada Rice. In shallow streams and around ponds and lakes, from Canada to Florida. This tall grass might be readily naturalized. Although its grain can be utilized for bread-corn, we would wish to possess the plant chiefly to obtain additional food of a superior kind for water-birds.

Zizania latifolia, Hance.* (*Hydropyrum latifolium*, Griesbach.) — The Kau-sun of China. In lakes of Amur, Manschuria, China, and Japan. Nearly related to the preceding species. From Dr. Hance we know that the solid base of the stem forms a very choice vegetable, largely used in China, where this tall water-grass undergoes regular cultivation like the *Trapa*.

Zizania miliacea, Michaux. — Southern part of North America, West India. Likewise tall and perennial, but more restricted to the tide-water meadows and ditches, according to Pursh ; but, according to Chapman's note, generally distributed, like *Z. aquatica*, with which it has similar use. In South Brazil occurs a similar grass, namely, *Z. microstachya*, Nees.

Zizyphus Jujuba, La Marek. — From India to China. This shrub or tree can be expected to bear its pleasant fruits only in the warmest parts of our colony. The fruit is red or yellow, and of the size of a large cherry.

Zizyphus rugosa, La Marek. — Nepal and other mountainous parts of India. A small tree, hardier than the last. The drupe of this is also edible, and the same may be said of a few other Indian species.

Zizyphus vulgaris, La Marek. — Orient, particularly Syria. A small tree, well adapted for our clime. Fruits scarlet, about an inch long, with edible pulp ; they are known as South European Jujubs.

CONCLUDING REMARKS.

THE writer, in concluding this small contribution toward the literature of industrial plants, could not but feel that he overstepped already the limits originally assigned to this communication. Yet, thus far extended as it is, it excludes many important genera and species altogether, not merely such as *Atalantia*, *Cynodon*, *Debregeasia*, *Villeburnia*, *Zamia* and others, which were inadvertently passed, but also numerous others of perhaps secondary note, yet sufficiently significant to be reserved for a supplemental treatise. Nevertheless, to about seven hundred prominent utilitarian plants now primary local attention has been directed in a connected form, which with the three hundred timber-trees, enumerated in last year's report of the Acclimatization Society, gives us a list of about one thousand plants for our cultural choice. But besides, indirectly or passingly, the writer has alluded to very many more; and these indications ought to aid many of our colonists to trace out still further novel resources for their requirements in husbandry or technology or any other purpose. It is the intention, at an early opportunity, to add to these lists, and to group also the products of the various timber-trees together in an augmented index, as many of these furnish also medicinal substances, dyes, oils, gums, resins, esculent fruits, and other

articles of our wants. Thus, notes for instance on camphor, vegetable tallow, real manna, maple-sugar, hickory-nuts, sandarac, turpentine, kauri, etc., must be sought among the timber-trees. Simultaneously, then, a geographic grouping of all these indicated plants will be effected, in order that at a glance may be indicated what from each particular country in various parts of the globe may be secured. The range of each recorded species is now already given with a view of affording a clearer insight into the adaptability of different climatic tracts and altitudes of this colony, or countries within the same isothermal lines for special plants. Furthermore, to give to benefactors abroad, who may wish to let us participate in their treasures of plants a more exact indication of our varied climatic zones, it was found expedient to append to this record a very succinct meteorologic schedule. Space did not admit of an enumeration of the many works of different nations, which may be consulted with advantage for following up the indications now given, but a list of the principal publications will be prepared for the supplement promised. It should, however, be stated, and this with regret, that the new work on vegetable industrial productions, published very recently by Mr. J. Smith of Kew, and resting largely on the notes of the late Alexander Smith, derived from the collections of Hooker's Museum, did not yet reach this country. Notes may hereafter also be added, distinguishing those plants which give an immediate return in one season, and those which produce their yield only in variously-extended periods. Likewise might be discriminated between those plants from

which commercial raw products are obtained, and those which require costly machinery or toilsome application, to perfect the mercantile article. The brief chemical notes are largely derived from Professor Wittstein's "Chemische Analyse von Pflanzentheilen," of which important work with the author's friendly concession a translation by the writer is early to appear. By these means industrial inquiry may here also be advanced, modern therapeutics for instance depending often, with far more exactness, on alkaloids or other chemically defined substances, than on the administration of a plant as a whole. In conclusion, the writer trusts that by the issue of these pages our transoceanic interchanges may become extended, and the vegetable treasures of distant countries may be rendered more extensively our own, while some slight advantage may also arise from these unpretensive data to countries endowed with climatic regions not dissimilar to those of Victoria.

TEMPERATURE OF AIR IN SHADE FOR THE LAST FOURTEEN YEARS.

From the Observatory Records at Melbourne.

	HIGHEST.	LOWEST.	MEAN.
At Melbourne.....	111·2	27·0	57·6
At Sandhurst.....	117·4	27·5	59·0
At Ballarat.....	109·0	22·0	53·2
At Portland.....	108·0	30·0	61·5
At Port Albert.....	.....	.....	56·5

RAINFALL AT MELBOURNE.

INCH.	INCH.	INCH.
In 1857.....28·90	In 1862.....22·08	In 1867.....25·79
In 1858.....26·02	In 1863.....36·43	In 1868.....18·27
In 1859.....21·80	In 1864.....27·40	In 1869.....24·59
In 1860.....25·40	In 1865.....15·94	In 1870.....33·75
In 1861.....29·15	In 1866.....22·41	In 1871.....30·17

TEM. OF AIR IN SHADE AT TWOFOLD BAY, 1871.

(Corresponding to the lowlands of East Gipps Land.)

From the Observatory Records of Sydney.

	MEAN.	M. MAX.	M. MIN.	E. MAX.	E. MIN.	R'FALL.
January.....	68·1	75·0	61·2	.....	.....	4·570
February.....	67·6	72·9	62·3	.....	.....	12·350
March.....	64·0	70·4	57·7	.....	.....	1·500
April.....	61·5	68·4	54·5	.....	.....	2·540
May.....	59·4	64·6	54·2	.....	.....	12·000
June.....	53·5	59·9	47·1	.....	.....	5·640
July.....	52·7	60·3	45·0	72·0	39·1	0·790
August.....	52·8	60·8	44·7	68·0	41·1	0·690
September.....	56·7	63·8	49·5	73·0	44·1	1·530
October.....	58·1	65·9	50·2	76·0	42·1	8·270
November.....	63·4	71·6	55·2	81·0	47·1	2·390
December.....	70·4	79·7	61·1	106·0	54·1	1·470

60·7° mean annual temperature. 53·740 inches rainfall for the year.

TEM. OF AIR IN SHADE AT TWOFOLD BAY, 1872.

From the Magistrate's Office at Eden.

	MAX.	MIN.	R'FALL.
	Deg.	Deg.	Inches.
January.....	88·0	61·0	3·15
February.....	83·0	63·0	1·15
March.....	81·0	58·0	1·92
April.....	62·0	55·0	1·03
May.....	62·0	47·0	1·08



Eucalyptus Globulus.
(Showing the Seed Cups.)

INDICATED GENERA.

CONTAINING

ALIMENTARY PLANTS :

1. *Yielding Herbage :*

Atriplex, Beta, Brassica, Chenopodium, Cichorus, Crambe, Hibiscus, Musa, Pringlea, Rheum, Rumex, Spinacia, Tetragonia.

2. *Yielding Roots :*

Apios, Arracacha, Asparagus, Beta, Butomus, Carum, Chærophyllum, Cichorium, Colocasia, Conopodium, Cyperus, Daucus, Dioscorea, Flemingia, Geitonoplesium, Gladiolus, Helianthus, Hypochoeris, Ipomæa, Manihot, Microseris, Oxalis, Pachyrrhizus, Peucedanum, Rhaponticum, Scilla, Scorzonera, Sechium, Selinum, Stilbocarpa, Tragopogon, Ullucus, Uvularia, Valeriana.

3. *Yielding Grain :*

Andropogon, Avena, Eleusine, Hordeum, Oryza, Panicum, Pennisetum, Secale, Zea, Zizania.

4. *Yielding Table Pulse :*

Cajanus, Cicer, Dolichos, Ervum, Lupinus, Phaseolus, Pisum, Vigna.

5. *Yielding various Esculent Fruits :*

Arachis, Corynosicyos, Cucumis, Cucurbita, Cynara, Fagopyrum, Sechium, Telfairia, Trapa, Voandzoa.

6. *Truffles :*

Terfezia, Tuber,

BAMBOO PLANTS :

Arundinaria (*Arundo*), *Bambusa*, *Guadua*, *Melocanna*, *Schizostachyum* ; (many other genera mentioned under *Schizostachyum*).

COFFEE PLANTS :

Coffea (doubtful).

CONDIMENT PLANTS :

Acorus, *Allium*, *Apium*, *Archangelica*, *Artemisia*, *Borrago*, *Brassica*, *Capparis*, *Capsicum*, *Carum*, *Chærophylum*, *Citrus*, *Cochlearia*, *Coriandrum*, *Crithmum*, *Cuminum*, *Fœniculum*, *Glycine*, *Illicium*, *Lepidium*, *Mentha*, *Ocimum*, *Olea*, *Origanum*, *Peucedanum*, *Pimpinella*, *Prunus* (*Amygdalus*), *Satureja*, *Sison*, *Smyrnum*, *Spilanthus*, *Tropæolum*, *Thymus*, *Valerianella*, *Zingiber*.

DYE PLANTS :

Alkanna, *Anthemis*, *Carthamus*, *Crocus*, *Crozophora*, *Helianthus*, *Indigofera*, *Isatis*, *Lawsonia*, *Lithospermum*, *Maharanga*, *Mallotus*, *Opuntia*, *Peireskia*, *Perilla*, *Reseda*, *Rhamnus*, *Rhus*, *Rubia*, *Sambucus*, *Saponaria*, *Solanum*, *Sophora*, *Spartium*, *Thymelæa*, *Xanthorrhiza*.

FIBER PLANTS :

Agave, *Apocynum*, *Behmeria*, *Broussonetia*, *Camelina*, *Cannabis*, *Corchorus*, *Cordyline*, *Crotalaria*, *Cyperus*, *Fourcroya*, *Gossypium*, *Helianthus*, *Hibiscus*, *Humulus*, *Lavatera*, *Linum*, *Maoutia*, *Musa*, *Pachyrrhizus*, *Phormium*, *Pipturus*, *Poa*, *Sesbania*, *Spartium*, *Yucca*.

FULLER'S PLANT :

Dipsacus.

FODDER PLANTS :

1. *Grasses* :

Agrostis, Alopecurus, Andropogon, Anthistiria, Anthoxanthum, Avena, Bromus, Cynosurus, Dactylis, Ehrharta, Eleusine, Festuca, Hierochloa, Hordeum, Leersia, Lolium, Panicum, Paspalum, Pennisetum, Phalaris, Phleum, Poa, Secale, Stenotaphrum, Tripsacum, Triticum.

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2. *Other Herbage* :

Cichorium, Pentzia, Prangos, Symphytum.

3. *Stable Pulse (Pods and Herb)* :

Cicer, Dolichos, Hedysarum, Lathyrus, Lupinus, Medicago, Melilotus, Onobrychis, Ornithopus, Pisum, Trifolium, Trigonella, Vicia.

4. *Other fruits* :

Argania, Helianthus, Prosopis.

GUM PLANTS :

Acacia, Astragalus, Olea, Prosopis.

HEDGE PLANTS :

Acacia, Agave, Cratægus, Justicia, Ligustrum, Maclura, Opuntia, Paliurus, Parkinsonia Peireskia, Prosopis, Prunus, Rhus, Rosa, Rubus, Salix.

HOP PLANT :

Humulus.

MEDICINAL PLANTS :

1. *Yielding Herbage or Flowers* :

Achillea, Aconitum, Aletris, Aloe, Althæa, Anemone, Anthemis, Arctostaphylos, Arnica, Artemisia, Atropa, Barosma, Cannabis, Cassia, Catha, Chelidonium, Chenopodium, Cochlearia,

Conium, Cytisus, Digitalis, Erythroxyton, Eupatorium, Hyoseyamus, Ilex, Justicia, Lactuca, Marrubium, Matricaria, Mentha, Menyanthes, Ophelia, Polygala, Prunus, Rafnia, Ricinus, Rosmarinus, Ruta, Salvia, Sambucus, Sebæa, Solanum, Spigelia, Tanacetum.

2. *Yielding Bark:*

Alstonia, Cinchona.

3. *Yielding Roots:*

Acorus, Actæa, Anacyclus, Archangelica, Aristolochia, Cephælis, Cimicifuga, Colchicum, Convolvulus, Gentiana, Glycyrrhiza, Helleborus, Hydrastis, Inula, Ipomæa, Nardostachys, Peucedanum, Pimpinella, Podophyllum, Saponaria, Saussurea, Schœnocaulon, Smilax, Symphytum, Urgania, Xanthorrhiza, Valeriana, Veratrum.

4. *Yielding Fruits (or only Seeds):*

Cucumis, Ecballion, Fœniculum, Illicium, Mallotus, Rhamnus, Rheum, Ricinus, Smyrnum, Trigonella.

OIL PLANTS:

Prunus (Amygdalus), Arachis, Argania, Brassica, Camelina, Cannabis, Cucurbita, Cyperus, Gossypium, Guizotia, Helianthus, Linum, Olea, Papaver, Ricinus, Sesamum, Telfairia.

ORCHARD PLANTS:

Amelanchier, Anona, Brabejum, Cervantesia, Citrus, Diospyros, Euclea, Ficus, Fragaria, Gaultheria, Gaylussacia, Hovenia, Morus, Musa, Myrica, Myrtus, Nephelium, Niemeyera, Opuntia, Parinarium, Passiflora, Peireskia, Persea, Physalis, Prunus, Psidium, Pyralia, Py-

rus, Ribes, Rubus, Santalum, Sechium, Shepherdia, Solanum, Tamarindus, Vaccinium, Vitis, Ximenia, Zizyphus.

PALM PLANTS :

Bactris, Calamus, Caryota, Ceroxylon, Chamærops, Hyphæne, Jubæa, Kentia, Livistona, Phœnix, Plectocomia, Ptychosperma, Rhaps, Sabal, Thrinax, Wallichia, Wettinia, Zalacca. (Many other American genera under Wettinia; many other Asian genera under Zalacca.)

PAPER PLANTS :

Arundo, Broussonetia, Cyperus, Lepidosperma, Stipa, Zea. (See also Fiber Plants.)

RESIN PLANTS :

Pistacia, Rhus, Styrax.

SAND-COAST PLANTS :

Agrostis, Asparagus, Crambe, Crithmum, Dactylis, Elymus, Ehrharta, Genista, Lepidosperma, Leptospermum, Panicum, Paspalum, Phormium, Poa, Prunus, Psamma, Sabal, Spartina, Stenotaphrum, Stipa, Tacca, Tetragonia, Thrinax, Urginia, Yucca.

SCENT PLANTS :

Acacia, Adesmia, Andropogon, Anthoxyanthum, Boronia, Cedronella, Citrus, Convolvulus, Dracocephalum, Hedeoma, Heliotropium, Jasminum, Lavandula, Lippia, Melissa, Mentha, Ocimum, Origanum, Pogostemum, Prunus (Amygdalus), Pycnanthemum, Reseda, Rosa, Rosmarinus, Satureja, Styrax, Teucrium, Thymus, Viola.

SILK PLANTS :

Morus, Quercus, Ricinus, Trophis.

STARCH PLANTS :

Alstroëmeria, Canna, Cycas, Fagopyrum, Hordeum, Maranta, Oryza, Secale, Solanum, Tacca, Triticum, Zea.

SUGAR PLANTS :

Andropogon, Beta, Cucumis, Saccharum, Zea.

TANNIC PLANTS :

Cytisus, Prosopis, Rhus.

TEA PLANTS :

Andropogon, Thea.

TOBACCO PLANTS :

Nicotiana.

WATER PLANTS :

Acorus, Æschynomene, Butomus, Cyperus, Menyanthes, Nelumbo, Oryza, Poa, Sagittaria, Trapa, Zizania.

WICKER PLANTS :

Salix. (Also genera mentioned under Bamboo Plants.)

ADDITIONS

TO THE

LISTS OF THE PRINCIPAL TIMBER TREES
AND OTHER SELECT PLANTS

READILY ELIGIBLE FOR

VICTORIAN INDUSTRIAL CULTURE,

OFFERED BY

BARON FERD. VON MUELLER,

C.M.G., M. and Ph.D., F.R.S.

In the first two volumes of the Proceedings of the Zoological and Acclimatization Society of Victoria, notes on about 300 of the most important timber-trees, and on about 700 species of other industrial plants were promulgated, with a view of affording some additional aid to colonists within our own territory, and perhaps also to inhabitants of other countries of a climate similar to ours, for choosing among the many thousands of predominantly utilitarian plants such species as can likely be grown to advantage in our geographic zone. On the occasions when these writings were issued, it was promised to offer, from time to time, supplements, comprising plants which, in the first instance, might have been overlooked, or which, through more extended researches or new discoveries, might have since become known or appreciated.

The first installment of these additions is now submitted to the Society's supporters, and further supplemental notes may find their way perhaps also to publicity through the volumes of the Acclimatization Society, so far as the scope of its publications affords space for such purposes. Some difficulty was again experienced on this occasion, not only in the selection of the plants to be recommended, but also in the limitation of the notes on any particular species. But not every plant placed here is actually to be regarded as of proved, extensive, industrial value ; or as of established remunerative cultural yield ; on the contrary, in the majority of instances they are only brought forward as recommendable for unbiased, new, and local tests by enlightened culturists. In reference to the narrow boundaries within which this and the two former treatises have been held, it may be observed that, until more voluminous writings of these kinds can appear through special public provision, the very brief data now additionally brought together may helpfully tend to the extension of cultural experiments, to the augmentation of our foreign intercourse for scientific, industrial, and mercantile purposes, and to the increase of our rural wealth.

Melbourne, May, 1874.

Aberia Caffra, Hooker.—The Kai Apple of Natal and Caffraria. This tall shrub serves for hedges. The rather large fruits are edible, and can be converted into preserves. Allied South African species are *A. Zeyheri* and *A. tristis* (Sonder).

Acacia Arabica, Willdenow. — Throughout Africa, also in South Asia. This small tree can be utilized

for thorny hedges, as also *A. Seyal* (Delisle) and *A. tortilis* (Forskæel). They all furnish the best Gum Arabic for medicinal and technical purposes. The Lac Insect lives also on the foliage, and thus, in Sind, the Lac is mainly yielded by this tree.

Acacia Concinna, Candolle. — India. Praised by Dr. Cleghorn as a valuable hedge-shrub. The pod contains Saponin. So is likewise *A. latronum* (Willd.), a hedge-bush.

Acacia Cavenia, Hooker and Arnott. — The Espino of the present inhabitants of Chile, the Cavan of the former population. A small tree, with exceedingly hard wood, resisting underground moisture. The plant is well adapted for hedges. The pods, called *quirinca*, serve as cattle-food (Dr. Philippi).

Acacia falcata, Willdenow. — East Australia. One of the best of trees for raising a woody vegetation on drift-sand, as particularly proved at the Cape of Good Hope. Other species serve the same purpose, for instance, *A. pycnantha*, *A. saligna*, *A. cyanophylla*, *A. salicina*.

Acacia fasciculifera, F. v. Mueller. — South Queensland. Desirable for culture on account of the excellence of its easily-worked wood.

Acacia glaucescens, Willdenow. — Queensland and New South Wales. Extreme height about 60 feet. A kind of Myall, with hard, dark, prettily-grained but less scented wood.

Acacia harpophylla, F. v. Mueller. — Southern Queensland, where this tree, according to Mr. Thozet, furnishes a considerable share of the mercantile wattle-bark for tanning purposes. Wood, according

to Mr. O'Shanesy, brown, hard, heavy, and elastic; used by the natives for spears.

Acacia horrida, Willdenow. — The Doornboom or Karra Doorn of South Africa. A formidable hedge-bush, with thorns three inches long, readily available for impenetrable hedge-copses. It exudes also a good kind of gum. So *A. Giraffæ* (Burchell).

Acacia lophantha, Willdenow. — South West Australia. One of the most rapidly-growing trees for copses and first temporary shelter in exposed localities, but never attaining to the size of a real tree. It produces seeds abundantly, which germinate most easily. For the most desolate places, especially in desert tracts, it is of great importance to create quickly shade, shelter, and copious vegetation. Cattle browse on the leaves. The bark contains only about 8 per cent. mimosin tannin; but Mr. Rummel found in the dry root about 10 per cent. of saponin, valuable in silk and wool factories.

Acacia pendula, All. Cunningham. — New South Wales and Queensland. Generally in marshy tracts of the interior. One of the Myall trees.

Acacia pycnantha, Bentham.*—Victoria and South Australia. Though frequent in many parts of our colony, this tree, known as the Golden Wattle, deserves even here extensive cultivation, mainly for the sake of its bark, rich in tannin. It is of rapid growth, will succeed even in sandy tracts, and yields seeds copiously, which germinate with the greatest ease. It is never a large tree. By improved methods the fragrant oil of the flowers could doubtless be fixed, though its isolation might be difficult and unremunerative. Experiments in the writer's laboratory have shown

that the perfectly-dried bark contains about 25 per cent. of mimosa tannin. The aqueous infusion of the bark can be reduced, by boiling, to a dry extract, which, in medicinal and other respects, is equal to the best Indian catechu, as derived from *Acacia catechu* and *A. sundra*. It yields, approximately, 30 per cent., about half of which, or more, is mimosa tannic acid. This catechu is also of great use for preserving against decay articles subject to exposure in water, such as nets, fishing-lines, etc. While, according to Mr. Simmons, the import of the bark of oaks and hemlock-spruce into England becomes every year less, and, while the import of sumach and gambir does not increase, the annual demand has, since the last 20 years, become doubled. Probably no other tanning-plants give so quick a return in cultivation as our *Acacia pycnantha*, and particularly *A. decurrens*. To the latter the Black Wattle is already alluded in the list of timber-trees; but the following additional notes may further show the importance of this neglected tree. The English price of the bark ranges generally from £8 to £11. It varies, so far as experiments under my direction have shown, in its contents of tannin, from 18 to 33 per cent. In the mercantile bark the percentage is somewhat less, according to the state of its dryness — it retaining about 10 per cent. moisture. Any bare, barren, unutilized places might here be sown most remuneratively with the seeds of this Wattle *Acacia*, to secure a regular and continuous supply of the bark, which necessarily must fall off under the indiscriminate arrangements of obtaining the bark from the natural localities of growth. The return would be within very few years. One and one half

pounds of Black Wattle-bark gives 1 pound of leather, whereas, 5 pounds of English Oak-bark are requisite for the same results, but the tannin principle of both is not absolutely identical. The bark of the variety passing generally as the Silver Wattle (*Acacia dealbata*, Link), is generally of less value, often even fetching only half the price of that of the Black Wattle. The tannin of these *Acaciæ* yields a gray precipitate, with the oxide salts of iron, and a violet color with sub-oxides; it is completely thrown down from a strong, aqueous solution by means of concentrated sulphuric acid. The bark improves by age and desiccation, and yields about 40 per cent. of catechu, rather more than half of which is tannic acid. Bichromate of potash, added in a minute quantity to the boiling solution of mimosa tannin, produces a ruby-red liquid, fit for dye purposes, and this solution gives, with the salts of suboxide of iron, black pigments, and with the salts of the full oxide of iron, red-brown dyes.

Acacia saligna, Wendland. —South-west Australia, where it is the principal tree chosen for tanner's bark. It is a widely-spreading, small tree, fit for avenues. The bark contains nearly 30 per cent. of mimosa-tannin.

Achillea moschata, Wulfen. —Alps of Europe. The Genipi or Iva of the alpine inhabitants. This perennial herb ought to be transferred to our snowy mountains. With the allied *A. nana*, L., and *A. atrata*, L., it enters as a component into the aromatic medicinal Swiss tea. Many species of this genus, including the Yarrow, are wholesome to sheep. *A. fragrantissima*, Reichenbach, is a shrubby species from the deserts of Egypt, valuable for its medicinal flowers.

Achras sapota, Linne. — The Sapodilla Plum of West India and Central Continental America. It is not improbable that this fine evergreen tree would produce its delicious fruit in East Gipps Land within Victorian boundaries, as tall palms and many other plants of tropical type occur there. Moreover, *Achras Australis*, a tree yielding also tolerably good fruit, occurs as far south as Kiama, in New South Wales, where the clime is very similar to that of many forest regions of Victoria. Other sapotaceous trees, producing table-fruit, such as the *Lucuma mammosa* (the Marmalade-tree), *Lucuma Bonplandi*, *Chrysophyllum Cainito* (the Star Apple), all from West India; and *Lucuma Cainito* of Peru might also be subjected to trial-culture in our warmest forest valleys; so furthermore many of the trees of this order, from which gutta-percha is obtained (species of *Isonandra*, *Sideroxylon*, *Ceratophoruts*, *Cacosmanthus*, *Bassia*, *Mimusops* and *Inbricaria*), may prove hardy in our sheltered woodlands, as they seem to need rather an equable, humid, mild clime than the heat of the torrid zone.

Adenostemum nitidum, Persoon. — South Chile, where this stately tree passes by the appellations: Queule, Nuble, and Arauco. Wood durable and beautifully veined. Fruit edible.

Agaricus Cæsareus, Schæffer. — In the spruce forests of Middle and South Europe. Trials might be made to naturalize this long-famed and highly delicious mushroom in our forests when spruce-fir plantations are made. It attains a width of nearly one foot, and is of a magnificent orange-color. Numerous other edible Agarics could doubtless be brought into these southern colonies by the mere dissemination of the

spores at apt localities. As large or otherwise specially eligible may here be mentioned *A. extincorius*, L., *A. melleus*, Vahl., *A. deliciosus*, L., *A. giganteus*, Sowerby, *A. Cardarella*, Fr., *A. Marzuolus*, Fr., *A. eryngii*, Cand., *A. splendens*, Pers., *A. odoratus*, Bulliard, *A. auricula*, Cand., *A. oreades*, Bolt., *A. esculentus*, Wulf, *A. mouceron*, Tratt., *A. socialis*, Cand., all from Europe, besides numerous other highly valuable species from other parts of the globe.

Agrostis rubra, Linné. (*A. borealis*, Hartmann.)—Northern Europe, Asia, and America. A perennial grass called Red-top, and also Herd-grass in the United States of North America. Mr. Meehan places it, for pastoral value, among grasses cultivated there, next after *Phleum pratense* and *Poa pratensis* (the latter there called Blue Grass), and before *Dactylis glomerata* (the Orchard Grass of the United States).

Aira cæspitosa, Linné.—Widely dispersed over the globe. A fair fodder-grass, best utilized for moist meadows.

Albizzia Lebbek, Benthani.—The *Siris Acacia* of South Asia. Available in the warmer parts of our colony as a shade-tree. It produces also a good deal of gum.

Allium roseum, Linné.—Countries on the Mediterranean Sea. This, with *Allium Neapolitanum* (Cyrillo), one of its companions, yields edible roots, according to Heldreich.

Aloexylon Agallochum, Loureiro.—Cochin China, on the highest mountains; thus, this tree would probably prove hardy here. The precious Aloe-wood, so famed for its balsamic fragrance and medicinal properties, is derived from this tree.

Anthistiria avenacea, F. v. Mueller.—New South

Wales and Queensland. A nutritious perennial pasture-grass.

Amarantus Blitum, Linné.—South Europe, North Africa, South-west Asia. This annual herb is a favorite plant among allied ones for spinach; but not only species of this genus, but also many other *Amarantaceæ* serve as culinary herbs.

Aponogeton distachyon, Thunberg.—South Africa. This curious water-plant, introduced already, might be naturalized in our ditches, swamps, and lakes, for the sake of its edible tubers. The scented flowering portion affords spinach.

Aralia cordata, Thunberg. — China. The young shoots provide an excellent culinary vegetable.

Arbutus Menziesii, Pursh. — North-west America. An evergreen tree, attaining a height of 150 feet. It belongs to the coast-tract exclusively. Wood exceedingly hard. The tree requires a deep, loamy soil, (Bolander); it would here be valuable at least as a highly ornamental garden-plant.

Aristolochia Indica, Linné. — Tropical Asia and Polynesia. A perennial climber; the leaves famed as an alexipharmic. Can only be grown in places free from frost.

Aristolochia recurvilabra, Hance.—The green Putchuck of China. A medicinal plant, largely obtained at Ningpo. The present value of its export is from £20,000 to £30,000 annually.

Artemisia Cina, Berg.—Kurdistan. This herb furnishes the genuine Santonica-seeds (or rather flowers and fruits), as a vermifuge of long established use. Some other Asiatic species yield a similar drug.

Artemisia Mutellina, Villars. — Alps of Europe.

This aromatic, somewhat woody plant, deserves to be established in our snowy regions.

Artemisia Pontioa, Linné.—Middle and South Europe, West Asia. More aromatic and less bitter than the ordinary wormwood. Many other species of this genus deserve attention of the culturist.

Arundo Ampelodesmos, Cyrillo. — South Europe, North Africa. Almost as large as *A. Gynarium*. The tough flower-stems and leaves readily available for tying.

Asparagus acutifolius, Linné.—In all the countries around the Mediterranean Sea, also in the Canary Islands. Although a shrubby asparagus, yet the root-shoots, according to Dr. Heldreich, are collected in Greece, and are tender and of excellent taste, though somewhat thinner than those of the ordinary herbaceous species. The shrub grows on stony rises, and the shoots are obtained without cultivation. *A. aphyllus*, L., and *A. horridus*, L., according to Dr. Reinhold, are utilized in the same manner, and all may probably yield an improved produce by regular and careful culture.

Asparagus laricinus, Burchell.—South Africa. Dr. Pappe observes of this shrubby species that, with some other kinds of that country, it produces shoots of excellent tenderness and aromatic taste.

Astragalus Parnassi, Boissier. (*A. Cylleneus*, Heldreich.)—Greece. This small shrub furnishes there almost exclusively the commercial Tragacanth. It ascends to elevations of 7,000 feet; becomes therefore alpine.

Atalantia glauca, J. Hooker. — New South Wales and Queensland. This desert-lemon is mentioned

here to draw attention to the likelihood of its improving in culture, and to its fitness of being grown on arid land.

Atriplex nummularium, Lindley. — From Queensland through the desert-tracts to Victoria and South Australia. One of the tallest and most fattening and wholesome of our pastoral salt-bushes, and although a native plant, even here highly recommendable for artificial rearing, as the spontaneously-growing plants, by close occupation of the sheep and cattle runs, have largely disappeared, and as this useful bush, even here, in many wide tracts does not exist.

Atriplex spongiosum, F. v. Mueller. — Through a great part of Central Australia, extending to the west coast. Available like the preceding, and like *A. halimoides*, *A. holocarpum* and several other species, for salt-bush culture.

Avena elatior, Linné. — Europe, Middle Asia, North Africa. This tall grass should not be passed altogether on this occasion, although it becomes easily irrepresible on account of its wide-creeping roots. It should here be chosen for dry and barren tracts of country, it having proved to resist our occasional droughts even better than rye-grass. The bulk yielded by it is great, it submits well to depasturing, and gives two or three crops of hay annually; it is, however, not so much relished by animals as many other grasses.

Averrhoa Carambola, Linné. — Insular India. Dr. Hooker having found this small tree on the Upper Indus as far as Lahore, it may reasonably be anticipated that success would attend its rearing in the warmest and moistest parts of our colonial territory. The fruit occurs in a sweet and acid variety; the for-

mer, when raw, is available for the table, the other for preserves. That of *A. Bilimbi* (Linné) is of similar use.

Azima tetraacantha, Lamarck.—From South India to South Africa. A hedge-bush, growing freely in every kind of soil.

Baccharis pilularis, Candolle.—California. This evergreen bush, like *B. consanguinea*, is grown for hedges; used also for garlands, wrappers of flower bouquets, and many decorative purposes, as cut branches do not wither for a considerable time. It attains a height of 15 feet (Professor Bolander).

Backhousia citriodora, F. v. Mueller.—S. Queensland. Though only a small tree it is well worth cultivating for the fragrance of its lemon-scented foliage.

Balsamodendron Ehrenbergi, Berg.—Deserts of Arabia. This tree yields the myrrh resin, but perhaps some other species may produce the same substance. Professor Oliver unites this with the following species.

Balsamodendron Opobalsamum, Kunth. (*B. Gileadense*, Kunth.)—Arabia and Nubia. This species furnishes the Mecca or Gilead Balsam. *B. Capense* (Sonder) is a closely allied species, from extra-tropical South Africa. Many other balsam shrubs deserve introduction.

Balsamodendron Mukul, Hooker.—Scinde and Beloochistan. Yields the Bdellium resin.

Basella lucida, Linné.—India. Perennial. This spinach-plant has somewhat the odor of *Ocimum Basilicum*; other species serve also culinary purposes.

Basella rubra, Linné.—From South Asia to Japan. This annual or biennial herb serves as a spinach of pleasant coloration.

Benincasa cerifera, Savi. — India. This annual plant produces a large edible gourd, which in an unripe state forms part of the composition of many kinds of curry.

Berberis Asiatica, Roxburgh. — Himalaya. One of the best among numerous species with edible berries. Among these may specially be mentioned *B. lycium*, Royle, and *B. aristata*, Candolle, which also yield valuable yellow dye-wood (Dr. Rosenthal).

Berberis Darwinii, Hooker. — Chiloe and South Chile. Considered one of the most handsome of all shrubs for garden-hedges. Several other evergreen Berberry shrubs serve the same purpose.

Betula lutea, Michaux. — The yellow or gray Birch of North-east America. Adapted for moist forest land. In size and most other respects similar to *B. lenta*.

Bongardia Rauwolfi, C. A. Meyer. — From Greece through Turkey to the Caucasus. A perennial herb, the leaves of which are utilized like culinary sorrel.

Boswellia papyrifera, A. Richard. — Morocco, Nubia, and Abyssinia, forming entire forests about Bertat on the Atlas. This tree exudes a kind of olibanum resin and represents apparently one of the hardiest species of this and allied genera.

Brassica juncea, J. Hook and Thoms. (*B. Willdenowii*, Boiss *Sinapis juncea*, Linné.) — From Middle Africa to China. According to Colonel Drury, cultivated all over India for sarepta mustard-seeds; also a good salad-plant.

Brassica Chinensis, Linné. — China and Japan. Serves, like the following, for cabbage, and may in cultivation produce new varieties. *B. cretica*, Lam., a woody, Mediterranean species.

Butea frondosa, Roxburgh.—The Dhak or Pulas of India. This magnificent tree extends to the Himalayan mountains, and therefore might here be a proper one for acclimatization. It is very rich in a peculiar kind of kino. The lac insect is also nourished by this tree, and might be transferred to us with it.

Buchloa dactyloides, Torrey.* — The true Buffalo-grass of Kansas. Dioecious, creeping, only rising to half a foot or less. It is extremely fattening, but apt to be suppressed by coarser grasses on places where these are not trampled out or kept down by the pasture animals.

Buddleya Madagascariensis, Lamarek.—Madagascar. Of the numerous species of *Buddleya*, the most eligible for shelter-copses on account of its great size and always tidy appearance, as well as vigor and celerity of growth. It is ever-flowering.

Buxus sempervirens, Linné. — Turkey Box-tree. South Europe, North Africa, South-west Asia. This slow-growing tree should timely be planted, to provide the indispensable box-wood for wood-engravers and musical-instrument makers, as yet no good substitute for it having been discovered. The box-tree needs calcareous soil for its best development. Among allied species *B. Balearica* attains a height of 80 feet. Other congeners are *B. subcolumellaris*, *B. Cubana*, *B. Purdieana*, *B. citrifolia*, *B. acuminata*, *B. lævigata*, *B. Vahlia*, *B. gonoclada*, *B. retusa*, *B. glomerata*, *B. Wrightii*, all from West India; further, *B. Madagascariensis*, *B. longifolia* from Turkey, *B. Wallichiana*, from the Himalayas, and *B. microphylla* from Japan, but neither or any of these, nor of the various species of the allied Indian genus *Sarcococca*, nor of several

species of the Andine genus *Styloceras*, does it appear to be known what relation their wood may hold to that of the true box-tree, and whether they are more rapid in growth.

Cæsalpinia coriaria, Willdenow. — Wet sea-shores of Central America. Might be naturalized in our salt-marshes. Colonel Drury states that each full-grown tree produces annually about 100 pounds of pods, the husk of which, commercially known as *Divi-Divi*, is regarded as the most powerful and quickly-acting tanning material in India. The mercantile price of the pods is from £8 to £13 per ton.

Cæsalpinia Sappan, Linné. — South Asia. The wood furnishes red dye. This shrub can also be utilized for hedges. It would likely prove hardy here in places free of frost.

Cæsalpinia sepiaria, Roxburgh. — South Asia, east to Japan. Can be utilized in the warmer tracts of our colony as a hedge-bush. It can advantageously be mixed for hedge-growth with *Pterolobium lacerans* (R. Br.), according to Dr. Cleghorn.

Cæsalpinia tinctoria, Humboldt. — Chile. The bark yields a red dye.

Calamagrostis longifolia, Hooker. — North America. Excellent for fixing drift-sand.

Calamintha Nepeta, Hoffmanssegg. — Is of the strongest odor among several species, but not of so pleasant a scent as *C. incana*, Boiss., and *C. grandiflora*, Moench.

Calamintha officinalis, Moench. — Middle and South Europe and Middle Asia, North Africa. A perennial herb, used, like melissa, as a condiment.

Calyptranthes aromatica, St. Hilaire. — South Brazil. This spice-shrub would likely prove hardy here; the

flower-buds can be used almost like cloves, the berries like allspice. Several other aromatic species are eligible for test-culture.

Capparis sepiaria, Linné.—From India to the Philippine Islands, ascending to cool elevations and living in arid soil. A prickly bush, excellent for hedges. Dr. Cleghorn mentions, also, as hedge-plants *C. horrida*, L. fil.), *C. aphylla*, Roth, *C. Roxburghii*, Cand., some of which yield also capers.

Caragana arborescens, Lamarck. — The Pea-tree of Siberia. The seeds are of culinary value, but particularly used for feeding fowl. The leaves yield a blue dye. (Dr. Rosenthal.)

Carex arenaria, Linné. — Europe and North Asia. One of the most powerful of sedges for subduing rolling sand, not attracting pasture animals by its foliage.

Carissa Arduina, Lamarek.—South Africa. A shrub with formidable thorns, well-adapted for boundary lines of gardens, where rapidity of growth is not an object. Quite hardy at Melbourne. *C. ferox*, E. Meyer, and *C. grandiflora*, A. de Cand., are allied plants of equal value. The East Australian, *C. Brownii* (F. von. Mueller), can be similarly utilized. The flowers of all are very fragrant. *C. Carandas*, Linné, extends from India to China; its berries are edible.

Carum nigrum, Royle.—Himalaya. With *C. gracile* this yields caraway-like fruits.

Carum Bulbocastanum, Koch.—Middle and South Europe, North Africa, Middle Asia, on lime-stone soil. The tuberous roots serve as a culinary vegetable, the fruits as a condiment.

Carum Capense, Sonder.—South Africa, where the edible, somewhat aromatic root is called Fenkelwortel,

Carum segetum, Bentham. (*Anethum segetum*, Linné.)—Around the Mediterranean Sea, extending to Middle Europe. An aromatic, annual herb, available for culinary purposes.

Cassia fistula, Linné.—South Asia. The long pods of this ornamental tree contain an aperient pulp of pleasant taste. Traced by Dr. Hooker to the dry slopes of the central Himalayas.

Casuarina Decaisneana, F. v. Mueller. — Central Australia, where it is the only species of the genus. This tree is one of the largest among its congeners, and particularly valuable for arid regions.

Casuarina torulosa, Aiton.—New South Wales and Queensland. The wood of this handsome tree is in demand for durable shingles and furniture work; it is also one of the best for oven fuel.

Castaneopsis chrysophylla, A. de Candolle. — The Oak Chestnut of California and Oregon. A tree attaining a large size of beautiful outlines. The leaves are golden yellow underneath. Wood durable.

Catalpa bignonioides, Walter.—On the Gulf of Mexico. A tree in warm, humid, climatic zones of remarkable celerity of growth. Mr. Meehan regards the wood to be as durable as that of the best chestnut-trees, and observed a stem in twenty years to attain a diameter of three feet, even in the clime of New York.

Ceanothus rigidus, Nuttall. — California. One of the best of hedge-shrubs, available for dry situations. Evergreen; up to 12 feet high; the branches become densely intricate. In the coast tracts it is replaced by *C. thyrsiflorus*, Esch., which can also be used for hedges and copses, and will live in mere

coast sand. *C. prostratus*, Benth., likes to form natural mats on slopes formed by roads and slides, which it gradually covers, and with its pretty blue flowers soon decorates. (Professor Bolander.)

Cercocarpus ledifolius, Nuttall. — California. Rises in favorable spots to a tree 40 feet high, with a stem diameter of $2\frac{1}{2}$ feet. The wood is the hardest known in California. *C. parvifolius* is of lesser dimensions.

Chærophyllum bulbosum, Linné. — Europe and Middle Asia. The root forms a kitchen vegetable. Several other species yield edible roots.

Chenopodium blitum, F. v. Mueller. (*Blitum virgatum*, Linné.) — From South Europe to India. An annual herb, extensively in use there as a cultivated spinach plant. The fruits furnish a red dye. The genus *Blitum* was reduced to *chenopodium* by the writer in Caruel's *Giornale Botanico* some years ago. *C. capitatum* (*Blitum capitatum*, L.) may not be really a distinct species. *C. Quinoa*, Willd., from Chile, deserves hardly recommendation for culture, though a nutritious spinach, it being apt to stray as a weed into cultivated fields. Some of these sorts of plants are useful to anglers, as attracting fish, when thrown into rivers or lakes.

Chlorogalum pomeridianum, Kunth. — California, frequent on the mountains. This lily-like plant attains a height of 8 feet. The heavy bulb is covered with many coatings, consisting of fibers, which are used for cushions, mattresses, etc.; large contracts are entered into for the supply of this material on a very extensive scale. (Professor Bolander.) The inner part of the bulb serves as a substitute for soap, and it might be tried whether it can be utilized for technological purposes like the root of *saponaria*.

Chloroxylon Swietenia, Candolle.—The Satin-wood. Mountains of India. Like the allied *Findersias*, possibly this tree would prove hardy here in naturally sheltered places, the cognate *Cedrela Taona* advancing in East Australia southward to the 35th degree. A resin, valuable for varnishes, exudes from the stem and branches.

Chrysanthemum roseum, Adam.—South-west Asia. This perennial herb, with *C. carneum*, yields the Persian insect powder.

Cinna arundinacea, Linné.—North America. There recorded as a good fodder-grass; perennial, somewhat sweet-scented. *Blyttia suaveolens* (Fries) is, according to Dr. Asa Gray, a variety with pendent flowers.

Cistus creticus, Linné. — Countries at the Mediterranean Sea. This shrub, with *C. cyprius* (Lam.), furnishes the best Ladanum resin. Other species yield a less fragrant product.

Combretum butyraceum, Caruel.—The Butter-tree of Caffraria and other parts of South-east Africa. The Caffirs call the fatty substance obtained from this tree *chiquito*. It is largely used by them as an admixture to their food, and exported also. It contains about one quarter olein and three quarters margarin. This butter-like fat is extracted from the fruit, and is of an aromatic flavor. The tree should be hardy in the warmer and milder parts of Victoria.

Cordyline Ti, Schott.—China. The roots in a roasted state are edible. The leaves, like those of other species, can be utilized for textile fiber.

Crambe cordifolia, Steven. — From Persia and the Caucasus to Thibet and the Himalayas, up to 14,000

fect. The root and foliage of this kale afford an esculent. *C. Kotschyana*, Boiss, is an allied plant.

Cratægus Azarolus, Linné.—Welsh Medlar. South Europe and South-west Asia. The pleasantly-acidulous fruits are much used for preserves.

Crocus serotinus, Salisbury. (*C. odorus*, Bivona.)—South Europe. Also this species produces Saffron rich in pigment. The bulbs of several are edible.

Cudrania Javensis, Trecul.—New South Wales and Queensland, south and east Asia to Japan, east Africa. This climbing, thorny shrub can be utilized for hedges. Fruit edible, of pleasant taste; the root furnishes a yellow dye.

Cymopterus glomeratus, Candolle.—Western States of North America. Root edible. (Dr. Rosenthal.)

Cynodon Dactylon, Persoon.*—Widely dispersed over the warmer parts of the globe, thus as indigenous reaching the northern parts of our colony. An important grass for covering bare, barren land, or binding drift-sand, or keeping together the soil of abrupt declivities, or consolidating earth-banks against floods. It is not without value as a pasture-grass, resists extreme drought, and may become of great importance to many desert-tracts. The dispersion is best effected by the creeping, rooting stems, cut into short pieces; each of these takes root readily. In arable land this grass, when once established, cannot easily be subdued. The stems and roots are used in Italy for preparing there the *Mellago graminis*. Roxburgh already declared this grass to be by far the most common and useful of India; that it flowers all the year, and that it forms three fourths of the food of the cows and horses there.

Danthonia Cunninghamsi, J. Hooker. — New Zealand. A splendid alpine fodder grass with large panicles.

Danthonia nervosa, J. Hooker. — Extra-tropic Australia. One of the best of nutritious swamp-grasses.

Danthonia pectinata, Lindley. — New South Wales, Queensland, and North Australia, in the arid, interior regions. A perennial desert-grass, resisting drought; sought with avidity by sheep, and very fattening to them.

Danthonia triticoides, Lindley. — Of nearly the same natural distribution as the preceding, and equaling that species in value. Both so important as to deserve rearing even in their native countries.

Debregeasia edulis, Weddell. — The *Janatsi-itsigo* or *Toon-itsigo* of Japan. Berries of this bush edible, fiber valuable for textile fabrics. A few Indian species, with fiber resembling that of *Bœhmeria*, ascend the Himalayas for several thousand feet, and may, therefore, be hardy here: namely, *D. velutina*, *D. Wallichiana*, *D. hypoleuca*; the latter extends to Abyssinia, where it has been noticed at elevations of 8,000 feet. On mountains in Java occurs *D. dichotoma*.

Desmodium triflorum, Candolle. — In tropical regions of Asia, Africa, and America. A densely-matted perennial herb, alluded to on this occasion as recommendable for places too hot for ordinary clover, and as representing a large genus of plants, many of which may prove of pastoral value. Dr. Roxburgh already stated that it helps to form the most beautiful turf in India, and that cattle are very fond of this herb. Colonel Drury informs us that it is springing up in

all soils and situations, supplying there the place of trifolium and medicago.

Dioscorea quinqueloba, Thunberg. — Japan, and there one of several yam plants with edible tubers. Among numerous congeners are mentioned as providing likewise root vegetables: *D. Piperifolia*, Humboldt, from Quito, *D. esurientum*, Fenzl, from Guatemala, *D. tuberosa* and *D. conferta*, Vellozo, from south Brazil, *D. Cayennensis*, Lamarck, from tropical South America, *D. triphylla*, Linné, from tropical Asia, *D. deltoidea*, Wallich, from Nepaul. Of these and many other species the relative quality of the roots and the degree of facility of their field cultivation require to be more fully ascertained.

Diospyros Ebenum, Retzius.* — Ceylon, where it furnishes the best kind of ebony wood. It is not uncommon up to 5,000 feet in that island, according to Dr. Thwaites, hence I would recommend this large and valuable tree for test plantations in East Gipps Land, and in other lowland forest regions of our colony, where also *D. quæsita*, and *D. oppositifolia* Thwaites, the best Calamander trees, and *D. Melanoxylon*, should be tried. Many other species of *Diospyros* could probably be introduced from the mountains of various tropical regions, either for the sake of their ebony-like wood or their fruit.

Diospyros Lotus, Linné.—From Northern China to the Caucasus. The ordinary Date Plum. The sweet fruits of this tree, resembling black cherries, are edible, and also used for the preparation of syrup. The wood, like that of *D. chloroxylon*, is known in some places as Green Ebony; it must, however, not be confounded with others, such as are furnished by some species of *Excæcaria*, *Nectandra*, and *Jacaranda*.

Dolichos uniflorus, Lamarck. — Tropical and subtropical Africa and Asia. An annual herb, well adapted for stable pulse.

Drimys Winteri, R. and G. Forster. — Extra-tropical South America. Canelo of Chile, sacred under the name of Boighe to the original inhabitants. Attains, in river-valleys, a height of 60 feet. The wood never attacked by insects (Dr. Philippi); thus the Australian species may be equally valuable.

Elæagnus parvifolius, Royle. — From China to the Himalayas. This bush has been introduced as a hedge-plant in North America, and, according to Mr. Meehan, promises great, permanent success, as it achieved already a high popularity in this respect. Several other species might well be experimented on in the same manner.

Elegla nuda, Kunth. — South Africa. A rush able with its long root to bind moving sand; it also affords good material for thatching (Dr. Pappe). Many of the tall Restiaceæ of South Africa would prove valuable for scenic effect in the gardens and conservatories, and among these may specially be mentioned *Cannamois cephalotes*, Beauv.

Embothrium coccineum, R. and G. Forster. — From Chile to Magellan's Straits. The Notra or Ciruelillo of Chile. A tree of exquisite beauty, but seldom extending to beyond 30 feet in height. The wood is utilized for furniture. *E. lanceolatum* is merely a variety (Dr. Philippi). The equally gorgeous *E. emarginatum* of the Peruvian Andes, and *E. Wickhami* from Mount Bellenden, Ker, of North Queensland, deserve, with the East Australian allied *Stenocarpus sinuatus*, a place in any sheltered gardens or parks of the warm temperate zone.

Encephalartos Denisonii, F. v. Mueller. — New South Wales and Queensland. This noble pine-palm is hardy here, and to be regarded as a most desirable acquisition to our garden sceneries, along with *E. spiralis*, *E. preissii* and the South African species. All admit of translocation, even when of large size, and when many years old. The stems, with an unusual tenacity of life, remain sometimes dormant after removal for several years.

Eucalyptus acmenoides, Schauer. — New South Wales and East Queensland. The wood used in the same way as that of *E. obliqua* (the Stringy-bark tree), but superior to it. It is heavy, strong, durable, of a light color, and has been found good for palings, flooring-boards, battens, rails, and many other purposes of house carpentry (Rev. Dr. Woolls).

Eucalyptus botryoides, Smith.—From East Gipps Land to South Queensland. One of the most stately among an extensive number of species, remarkable for its dark-green shady foliage. It delights on river-banks. Stems attain a length of 80 feet without a branch, and a diameter of 8 feet. The timber usually sound to the centre, adapted for water-work, waggon-knees of boats, etc. Posts of it very lasting, as no decay was observed in fourteen years.

Eucalyptus brachypoda, Turczaninow.—Widely dispersed over the most arid extra-tropical as well as tropical inland regions of Australia. One of the best trees for desert-tracts; in favorable places 150 feet high. Wood brown, sometimes very dark, hard, heavy, and elastic, prettily marked; thus used for cabinet-work, but more particularly for piles, bridges, and railway sleepers (Rev. Dr. Woolls).

Eucalyptus calophylla, R. Brown. — South - west Australia. More umbrageous than most Eucalypts, and of comparatively rapid growth. The wood is free of resin when grown on alluvial land, but not so when produced on stony ranges. It is preferred to that of *E. marginata* and *E. cornuta* for rafters, spokes, and fence-rails ; it is strong and light, but not long-lasting under ground. The bark is valuable for tanning, as an admixture to acacia bark.

Eucalyptus cornuta, Labillardiere. — South - west Australia. A large tree, of rapid growth, preferring a somewhat humid soil. The wood is used for various artisan's work, and there preferred for the strongest shafts and frames of carts and other work requiring hardness, toughness, and elasticity.

Eucalyptus crebra, F. v. Mueller. — The narrow-leaved iron-bark tree of New South Wales and Queensland. Wood reddish, hard, heavy, elastic, and durable, much used in the construction of bridges ; also for wagons, piles, fencing, etc. *E. melanophloia* (F. v. M.), the silver-leaved, iron-bark tree, and *E. leptophleba*, *E. trachyphloia*, and *E. drepanophylla* are closely-allied species, of similar value. They all exude astringent gum-resin in considerable quantity, resembling kino in appearance and property.

Eucalyptus Doratoxylon, F. v. Mueller. — The spear-wood of South-west Australia, where it occurs in sterile districts. The stem is slender and remarkably straight, and the wood of such firmness and elasticity that the nomadic natives wander long distances to obtain it as material for their spears.

Eucalyptus eugenioides, Sieber. — New South Wales. Regarded by the Rev. Dr. Woolls as a fully distinct

species. Its splendid wood, there often called blue-gum-tree wood, available for many purposes, and largely utilized for ship-building.

Eucalyptus Gunnii, J. Hooker.—Victoria, Tasmania, and New South Wales, at alpine and sub-alpine elevations. The other more hardy Eucalypts comprise *E. coriacea*, *E. alpina*, *E. urnigera*, *E. coccifera*, and *E. vernicosa*, which all reach heights covered with snow for several months in the year.

Eucalyptus goniocalix, F. v. Mueller.—From Cape Otway to the southern parts of New South Wales. A large tree, which should be included among those for new plantations. Its wood resembles, in many respects, that of *E. globulus*. For house-building, fence-rails, and similar purposes, it is extensively employed in those forest-districts where it is abundant, and has proved itself a valuable timber.

Eucalyptus hemiphloia, F. v. Mueller.—New South Wales and South Queensland. To be regarded as a timber-tree of great excellence, on the authority of the Rev. Dr. Woolls. It is famous for the hardness and toughness of its timber, which is used for shafts, spokes, plow-beams, and similar utensils.

Eucalyptus Leucoxydon, F. v. Mueller.—The ordinary iron-bark tree of Victoria and some parts of South Australia and New South Wales. As the supply of its very durable timber is falling short, and as it is for some purposes superior to that of almost any other Eucalypt, the regular culture of this tree over wide areas should be fostered, especially as it can be raised on stony ridges, not readily available for ordinary husbandry. The wood is sometimes pale, or in other localities rather dark. The tree is generally restricted

to the lower silurian sandstone and slate formation with ironstone and quartz. It is rich in kino. *E. sideroxylon* is a synonym.

Eucalyptus maculata, Hooker.—The spotted gum-tree of New South Wales and South Queensland. A lofty tree, the wood of which is employed in ship-building, wheelwrights' and coopers' work. The heartwood as strong as that of British oak (Rev. Dr. Woolls).

Eucalyptus obliqua, P'Heritier.* — The ordinary stringy-bark tree, attaining gigantic dimensions. The most extensively distributed and most gregarious of all Eucalypts; from Spencer's Gulf to the southern part of New South Wales, and in several varieties designated by splitters and other wood-workers by different names; most extensively used for cheap fencing-rails, palings, shingles, and any other rough wood-work, not to be sunk underground nor requiring great strength or elasticity. The bulk of wood obtained from this tree in very poor soil is perhaps larger than that of any other kind, and thus this species can be included even here, where it is naturally common and easily redisseminated, among the trees for new forest plantations in barren, woodless tracts of our own country, to yield readily and early a supply of cheap and easily fissile wood.

Eucalyptus paniculata, Smith. — The White Iron-bark tree of New South Wales. All the trees of this series are deserving of cultivation, as their wood, though always excellent, is far from alike, and that of each species preferred for special purposes of the artisans.

Eucalyptus Phœnicea, F. v. Mueller.* — Carpenta-

ria and Arnheim's Land. Of the quality of the timber hardly anything is known, but the brilliancy of its scarlet flowers recommends this species to a place in any forest or garden-plantation. For the same reason, also, *E. miniata*, from North Australia, and *E. ficifolia*, from South-west Australia, should be brought extensively under cultivation.

Eucalyptus pilularis, Smith. — The Black-butt tree of South Queensland, New South Wales, and Gipps Land. One of the best timber-yielding trees about Sydney, of rather rapid growth (Rev. Dr. Woolls). It is much used for flooring-boards.

Eucalyptus platyphylla, F. v. Mueller. — Queensland. Regarded by the Rev. Julian Tenison Woods as one of the best of shade-trees, and seen to produce leaves sometimes $1\frac{1}{2}$ feet long and 1 foot wide. This tree is available for open, exposed localities, where trees from deep forest valleys would not thrive.

Eucalyptus robusta, Smith. — New South Wales. The timber in use for ship-building, wheelwrights' work, and many implements, such as mallets, etc.

Eucalyptus resinifera, Smith. — The Red Mahogany Eucalypt of South Queensland and New South Wales. A superior timber-tree, according to the Rev. Dr. Woolls, the wood being much prized for its strength and durability.

Eucalyptus siderophloia, Bentham.* — The large-leaved or red Iron-bark tree of New South Wales and South Queensland. According to the Rev. Dr. Woolls this furnishes one of the strongest and most durable timbers of New South Wales; with great advantage used for railway sleepers and for many building purposes. It is harder even than the wood of *E. sideroxylon*, but thus also worked with more difficulty.

Eucalyptus tereticornis, Smith.—From East Queensland to Gipps Land. Closely allied to *E. rostrata*, and seemingly not inferior to it in value.

Eucalyptus tessellaris, F. v. Mueller. — North Australia and Queensland. Furnishes a brown, rather elastic wood, not very hard, available for many kinds of artisans' work, and particularly sought for staves and flooring. The tree exudes much astringent gum-resin (P. O'Shanesy). Many other Eucalypts could have been mentioned as desirable for wood-culture, but it would have extended this enumeration beyond the limits assigned to it. Moreover, the quality of many kinds is not yet sufficiently ascertained, or not yet fully appreciated even by the artisans and woodmen.

Eucryphia cordifolia, Cavanilles.—The Muermo, or Ulmo of Chile. This magnificent evergreen tree attains a height of over 100 feet, producing a stem of sometimes 6 feet diameter. The flowers are much sought by bees. For oars and rudders the wood is preferred in Chile to any other (Dr. Philippi). We possess congeneric trees in Tasmania (*E. Billardieri*) and in New South Wales (*E. Moorei*).

Eugenia cordifolia, Wight. — Ceylon, up to 3,000 feet high. Fruit of one inch diameter.

Eugenia Hallii, Berg.—Quito. Fruit of large size.

Eugenia maboides, Wight. — Ceylon, up to 7,000 feet elevation. Fruit of the size of a small cherry (Dr. Thwaites).

Eugenia Malaccensis, Linné.—The large Rose Apple, India. Although strictly a tropical tree, it has been admitted into this list as likely adapted for our warmer forest regions. The leaves are often a foot

long. The large fruits, of rosy odor, are wholesome and of agreeable taste. *E. Jambos*, L., also from India, produces likewise excellent fruit.

Eugenia Nhanica, Cambessedes. — South Brazil. The berries, which are of plum size, are there a table fruit.

Eugenia pyriformis, Cambessedes. — Uvalho do Campo of South Brazil. Fruit of pear size.

Eugenia revoluta, Wight. — Ceylon, up to heights of 6,000 feet. Berry one inch in diameter.

Eugenia rotundifolia, Wight. — Ceylon, up to 8,000 feet, rejoicing therefore in a cool or even cold climate.

Eugenia supra-axillaris, Spring. — The Tata of South Brazil. Fruit large.

Eugenia Zeyheri, Harvey. — South Africa. A tree attaining 20 feet in height. The berries are of cherry size, and edible. The relative value of the fruits of many Asiatic, African, and American species of *Eugenia* remains to be ascertained; many of them furnish doubtless good timber, and all more or less essential oil; some, probably, also superior fruit. All such, even tropical trees, should be tested in East Gipps Land and other warm tracts of our colony, inasmuch as many of them endure a cooler clime than is generally supposed. Hence, *Anona muricata* (L.), the Soursop-bush of West India, should also be subjected to test-culture for the yield of its sweet, fragrant, melon-like fruit; and not less so, *Anona squamosa*, (L.), the sweetsop shrub or tree of Central America, for the sake of its very pleasant fruit.

Euryale ferox, Salisbury. — From tropical Asia to Japan. Though less magnificent than the grand *Victoria Regia*, this closely-allied water-lily is much

more hardy, and would live unprotected in ponds and lakes of our colony. Though not strictly an industrial plant, it is not without utility, and undergoes some sort of cultivation in China for yielding its edible root and seeds.

Euryangium Sumbul, Kaufmann. — Central Asia. Yields the true sumbul root.

Fagus Dombeyi, Mirbel. — The evergreen Beech of Chile, called there the Coigue or Coihue. Of grand dimensions. Canoes out of its stem can be obtained of a size to carry ten tons of freight. The wood is still harder than that of the following species, with the qualities of which it otherwise agrees (Dr. Philippi). This species extends to the Chonos group, and, perhaps, still further south, and thus might be of value even for middle European forest-culture.

Fagus obliqua, Mirbel. — The Roble of Chile, called Coyam by the original inhabitants. A tall tree with a straight stem, attaining 3 to 4 feet in diameter. Wood heavy and durable, well adapted for posts, beams, girders, rafters, joists, etc., but not for flooring. One of the few Chilean trees with deciduous foliage. (Dr. Philippi.) Its value, as compared to that of the European beech, should in our forest plantations be tested.

Fagus proccera, Poeppig. — Another deciduous beech of Chile, where it passes by the names Reulé or Rauli. Of still more colossal size than the Roble. Wood fissile, but well-adapted for staves; it is finer in grain than that of *F. obliqua*, and much used for furniture. (Dr. Philippi.)

Ferula longifolia, Fischer. — South Russia. The aromatic, long roots furnish a pleasant vegetable. (Dr. Rosenthal.)

Festuca coiron, Steudel. — Chile. A valuable perennial fodder-grass, according to the testimony of Dr. Philippi.

Festuca distichophylla, J. Hooker. — Victoria, South Australia, Tasmania, New South Wales. This dwarf creeping grass is of great value for binding soil, forming rough lawns, edging garden-plots on arid places, and covering coast-sand.

Festuca dives, F. v. Mueller.* — Victoria, from West Gipps Land to Dandenong and the sources of the rivers Yarra and Goulburn. One of the most magnificent of all sylvan grasses, not rarely 12 feet, and exceptionally to 17 feet high. Root perennial. This grass deserves to be brought to any forest tracts, as it prospers in shade; along rivulets, in deep soil, it assumes its grandest forms. The large panicle affords nutritious forage.

Festuca flava, F. v. Mueller. (*Poa flava*, Gronov, *Tricuspis seslerioides*, Torr., *Uralepis cuprea*, Kunth.) — The tall red-top-grass of the Eastern States of North America. A perennial sand-grass, with wide panicles.

Festuca gigantea, Villars. — Europe and Middle Asia. A perennial, good, forest-grass.

Festuca heterophylla, Lamarek. — Mountains of Europe. This perennial grass attains a height of five feet; it produces a proportionately great bulk of fodder, and serves as an admixture to grasses of hay or pasture lands, particularly the former (Lawson). It is best fitted for our alpine and highest forest-tracts, which, in course of time, and, perhaps early so, will be sought for close pastoral occupation, when territorial areas will become less easily acquired.

Festuca spadicea, Linné. — Alps of Europe. This

grass would thrive on the heights of our snowy mountains. Perennial.

Festuca purpurea, F. v. Mueller. (*Uralepis purpurea*, Nutt., *Tricuspis purpurea*, A. Gray.)—South-east coast of North America. A tufty sand-grass, but annual.

Festuca silvatica, Villars.—Middle and south Europe. A notable forest-grass. *F. drymeia* (Mert. and Koch), a grass with long, creeping roots, is closely allied. Both deserve here test-culture.

Ficus columnaris, Moore and Mueller.—The Banyan-tree of Lord Howe's Island, therefore extra-tropical. One of the most magnificent productions in the whole empire of plants. Mr. Fitzgerald, a visitor to the island, remarks that the pendulous air-roots, when they touch the ground, gradually swell into columns of the same dimensions as the older ones, which already become converted into stems, so that it is not apparent which was the parent trunk; there may be a hundred stems to the tree on which the huge dome of dark evergreen foliage rests, but these stems are all alike, and thus it is impossible to say whence the tree comes or whither it goes. The allied fig-trees of continental East Australia have great buttresses, but only now and then a pendulous root, approaching in similarity the stems of *Ficus columnaris*. The Lord Howe's Island fig-tree is more like *F. macrophylla* than *F. rubiginosa*; but *F. columnaris* is more rufous than either. In humid, warm, sheltered tracts of Victoria this grand vegetable living structure may be raised as an enormous bower for shade, and for scenic ornament. The nature of the sap, whether available for caoutchouc or other industrial material, requires yet to be tested.

Ficus Cunninghami, Miquel.—Queensland, in the eastern dense forest regions. Mr. O'Shanesy designates this as a tree of sometimes monstrous growth, the large, spreading branches sending down roots which take firm hold of the ground. One tree measured was 38 feet in circumference at two feet from the ground, the roots forming wall-like abutments, some of which extended 20 feet from the tree. Several persons could conceal themselves in the large crevices of the trunk, while the main branches stretched across a space of about 100 feet. A kind of caoutchouc can be obtained from this tree. A still more gigantic fig-tree of Queensland is *F. colossea* (*F. v. M.*), but it may not be equally hardy, not advancing naturally to extra-tropic latitudes. This reminds of the great council-tree, *F. altissima*.

Ficus elastica, Roxburgh.*—Upper India. A large tree, yielding its milk-sap copiously for caoutchouc. Already Roxburgh ascertained, 60 years ago, that india-rubber could be dissolved in cajaput oil (so similar to our eucalyptus oil), and that the sap yielded about one third of its weight caoutchouc. This tree is not of quick growth in the changeable and often dry clime of Melbourne, but there is every prospect that it would advance rather rapidly in any of our extensively unutilized forest gullies, and that copious plantations of it there would call forth a new local industry. Mr. S. Kurz states that also *F. laccifera*, Roxb., from Silhet, is a caoutchouc fig-tree, and that both this and *F. elastica* yield most in a ferruginous clay soil on a rocky substratum; further, that both can bear dryness, but like shade in youth. Several other species of tropical figs, as well American as

Asiatic, are known to produce good caoutchouc, but it is questionable whether any of them would prosper in our southern latitudes ; nevertheless, for the conservatories of botanic gardens, all such plants should be secured, with a view of promoting public instruction.

Ficus rubiginosa, Desfontaines.—New South Wales. One of the most hardy of all fig-trees, and very eligible among evergreen shade - trees. It is estimated that the genus *Ficus* comprises about 600 species, many occurring in cool mountain regions of tropical countries. The number of those which would endure our clime is probably not small.

Flindersia Oxleyana, F. von Mueller.—The Yellow Wood of New South Wales and Queensland. Other species occur there, among which *F. Bennettiana* is the best for avenue purposes.

Fitzroya Patagonica, J. Hooker.*—Chile as far south as Chiloe. The Alerce of the Chileans. Grows on swampy, moory places. The diameter of the stem reaches sometimes the extraordinary extent of 15 feet. The wood is almost always red, easily split, light, does not warp, stands exposure to the air for half a century, and in Valdivia and Chiloe almost all buildings are roofed with shingles of this tree (Dr. Philippi). Like *Libocedrus tetragona*, this tree should be extensively planted in our unutilized swampy moors.

Flacourtia Ramontchi, l'Heritier. (*F. sapida*, Roxburgh.)—India up to Beloochistan. This and *F. cataphracta*, Roxb., form thorny trees with somewhat plum-like fruits. With other species they can be adopted for hedge-copses.

Flueggea Japonica, C. Richard.—China and Japan.

The mucilaginous tubers can be used for food, a remark which applies to many other as yet disregarded lilaceous plants.

Fraxinus Oregana, Nuttall.—California and Oregon. Delights on river-banks. Wood durable and elastic (Bolander). Well available for planting along our numerous forest-brooks.

Garuleum bipinnatum, Lessing.—South Africa. A perennial herb of medicinal properties, and, like numerous other plants there and elsewhere, praised as an alexipharmic, but all requiring close re-investigation in this respect.

Gelsemium nitidum, Michaux. — Southern States of North America and Mexico. A twining, shrubby plant of medicinal value, long since introduced into Australia by the writer, like numerous other plants of industrial or therapeutical importance. Active principle, Gelseminin. The scent of the flowers has also come into use as a cosmetic.

Gonioma Kamassi, E. Meyer.—South Africa. This small tree furnishes the yellow Kamassi-wood, much sought for carpenter's tools, planes, and other select articles of wood-work; also for wood-engraving, according to Dr. Pappe. Flowers deliciously fragrant.

Grumilea cymosa, E. Meyer. — South Africa. Dr. Pappe describes the wood of this tree as a beautiful citron-yellow.

Guevina Avellana, Molina.—Extends from Middle Chile to the Chonos Archipelago. Briefly alluded to already, in the list of trees desirable for Victorian forest-culture. One of the most beautiful trees in existence. The snowy-white flower-spikes produced simultaneously with the ripening of the coral-red

fruit. In the cooler southern regions the tree attains considerable dimensions. The wood tough and elastic—used for boat-building (Dr. Philippi). The fruit of the allied *Brabejum stellatifolium* can only be utilized with caution in a roasted state as an article of diet, because it is noxious or even absolutely poisonous in a raw state.

Guilandina Bonduc, Linné. — Widely dispersed through the inter-tropical regions of both hemispheres with *G. Bonducella*, L. Both would be well adapted for hedges in the warmer parts of our colony.

Gunnera Chilensis, Lamarck.—From Caracas to Patagonia, chiefly on cliffs. A most impressive plant for scenic groups in gardens. Darwin measured leaves 8 feet broad and 24 feet in circumference. The acidulous leaf-stalks serve as a vegetable; the thick roots are used for tanning and dyeing. *G. macrophylla*, Blume, is a native of Java and Sumatra, where it occurs on mountains, up to 6,000 feet.

Harpullia Hillii, F. v. Mueller.—The Tulip-wood of Queensland. One of the most valuable of the numerous kinds of trees indigenous there for select cabinet-work.

Heleocharis tuberosa, Roemer and Schultes.—China, where it is called Matai, or Petsi. This rush can be subjected to regular cultivation in ponds for the sake of its edible, wholesome tubers. *H. plantaginea* and *H. fistulosa*, of India, and our own native *H. sphaelata* are allied plants.

Helichrysum lucidum, Henckel. (*H. bracteatum*, Willdenow.)—Throughout the greater part of Australia. The regular cultivation of this perennial herb would be remunerative to supply its everlasting flow-

ers for wreaths, just like those of *H. orientale* (Tournefort), from Candia, are largely grown and sold in South Europe to provide grave-wreaths. Furthermore, the lovely *Helipterum Manglesii* (F. v. M.), from West Australia, could for like purposes be profitably reared on a large scale, with several other Australian everlasting. Some South African species of *Helichrysum* and *Helipterum* are also highly eligible for these purposes of decoration.

Hibiscus Ludwigii, Ecklon and Zeyher. — South Africa. A tall, shrubby and highly ornamental species, desirable also as yielding a fiber of great strength and toughness.

Hierochloa redolens, R. Brown. — Alps of Australia, Tasmania, New Zealand, Fuegia. Like other species of this genus, a valuable fodder-grass, of powerful and agreeable scent. It is one of the largest kinds.

Holcus mollis, Linné.* — Of nearly the same geographic range and utility as the preceding species.

Holcus lanatus, Linné.* — Europe, North Africa, Middle Asia. A well-known and easily-disseminated perennial pasture-grass, of considerable fattening property.

Holoptelea integrifolia, Planchon. (*Ulmus integrifolia*, Roxburgh.) — The Elm of India, extending from the lowlands to sub-alpine regions. A large tree, with timber of good quality. Foliage deciduous.

Hydnum imbricatum, Linné. — In pine forests of Europe. A wholesome mushroom of delicious taste, which we should endeavor to naturalize in our pine plantations. Other recommendable European species are: *H. erinaceum*, Pers., *H. coralloides*, Scop., *H.*

album, Pers., *H. diversidens*, Fries, *H. auriscalpium*, Linné, *H. subsquamosum*, Batsch, *H. lævigatum*, Sw., *H. violascens*, Alb., *H. infundibulum*, Sw., *H. fuligineo album*, Schm., *H. graveolens*, Brot., *H. Caput Medusæ*, Nees, *H. Hystrix*, Fries. These and other edible fungi are given on the authority of Rosenthal's valuable work.

Hymenæa Courbaril, Linné.—Tropical and southern sub-tropical America. A tree of colossal size and remarkable longevity. Timber hard, extremely ponderous, close-grained, used for select wheel-work, tree-nails, beams and planks in various machinery. A fragrant, amber-like resin, known as West India Copal, exudes from the stem. The beans of the pod are lodged in a mealy pulp of honey-like taste, which can be used for food. The possibility of the adaptability of this remarkable tree to the warmer parts of Victoria needs to be ascertained.

Ilex Cassine, Linné.—Southern States of North America. A tea-bush, to which also remarkable medicinal properties are ascribed.

Ipomæa Batatilla, G. Don.—Cooler regions of Venezuela. The tubers serve as sweet potatoes. Similarly useful *I. platanifolia*, Roem. and Schult, from Central America, and *I. mammosa*, Choisy, from Ambonia.

Juglans cordiformis, Maximowicz.—Japan. This species approaches, in many respects, *J. Sieboldiana*.

Juglans Mandschurica, Maximowicz.—Corea and Mandschurica. This walnut is allied to *J. cinerea* of North America.

Juglans Sieboldiana, Maximowicz.—Throughout Japan, where it forms a large tree.

Juglans stenocarpa, Maximowicz. — From the Amoor territory. Allied to *J. Mandschurica*.

Koeleria cristata, Persoon. — Widely dispersed over the globe. A perennial grass of fair nutritive quality, sustaining itself on dry soil. The closely-allied *K. glauca* can be sown with advantage on coast sand.

Lactuca sativa, Linné. — South Asia. The ordinary annual lettuce, in use since remote antiquity. It is not without value, especially as a sedative for medicinal purposes.

Lapageria rosea, Ruiz and Pavon. — Chile. A half-woody climber with large, showy flowers. The berries, which are of the size of a hen's egg, are sweet and edible.

Lardizabala biternata, Ruiz and Pavon. — Peru and Chile, south to 37th degree. A woody climber. The berries, two to three inches long, and about one inch broad, possess a pleasant, sweet pulp. Two other similarly useful plants exist there.

Laserpitium aquilegium, Murray. — Middle and South Europe. The stems of this perennial herb are edible. The fruits serve as a condiment.

Lathyrus sativus, Linné. — Can only be used with great caution, as its frequent or continuous use induces, like *L. Cicera*, paralysis, not only to man, but also to horses, cattle, and birds.

Laurelia aromatica, Poiret. — Southern Chile. A colossal tree, in Valdivia the principal one used for flooring. Wood never bored by insects, and well apt to stand exposure to the open air; far superior to that of *L. serrata*, the Vauvan or Huahua, which tree predominates over *L. aromatica* in the far south of Chile (Dr. Philippi).

Laurus nobilis, Linné.* — Asia Minor. The Warrior's Laurel of the ancients. The leaves are in much request for various condiments, and the peculiar aroma of these bay-leaves cannot be replaced by any others, unless those of *Lindera Benzoin*.

Leyssera gnaphalioides, Linné.—South Africa. A perennial herb of aromatic scent and taste. Much used there as a medicinal tea.

Lespedeza striata, Hook. and Arnott.*—China and Japan. An annual herb, which in North America has proved of great use. Mr. Meehan states it to be identical with the Hoop Koop plant, and that it has taken possession of much waste land in the Southern States. It grows there wonderfully on the hot, dry soil, and the cattle like it amazingly.

Levisia rediviva, Pursh. — North - west America. The root of this herb is large and starchy, formerly extensively used by the native inhabitants. The plant deserves trial-culture.

Liatris odoratissima, Willdenow.—Southern States of North America. A perennial herb occurring on swampy places.

Libocedrus tetragona, Endlicher.* — Chile, as far south as Magellan's Straits, especially in moist, moory localities. The wood, though soft and light, is resinous, and will resist underground decay for a century and more, like that of *Fitzroya Patagonica*; for railway-sleepers this timber is locally preferred to any other (Dr. Philippi).

Lindera Benzoin, Blume. — From Canada to the Gulf of Mexico, there called the spice - laurel. An aromatic bush, one of the hardiest of the order. The aroma of the foliage much like that of the bay-leaves.

Liquidambar orientalis, Miller.* (*L. imberbe*, Aiton.) Asia Minor. Also this tree yields liquid Storax, which is vanilla-scented, containing much Cumarin, and thus used for imparting scent to some sorts of tobacco and cigars, also for keeping moths from woolen clothing. Its use in medicine is more limited than in perfumery.

Lotus corniculatus, Linné.* Birdsfoot - trefoil.—Europe, North Africa, North and Middle Asia, extra-tropical Australia. A deep-rooting perennial herb, readily - growing on pasture land, sandy links, and heathy places. This plant is well deserving cultivation on light, inferior soil, on which it will yield a greater bulk of herbage than any of the other cultivated clovers; it is highly nutritious, and eaten with avidity by cattle. From the great depth to which its roots penetrate it is not liable to be injured by drought. The nearly-allied *L. major* yields a still greater amount of herbage; it is particularly suited for bushy and moist localities, and it attains its greatest luxuriance on soils which have some peat in their composition (Lawson). Here in Australia this *Lotus* shows a decided predilection for wet meadows.

Lotus Tetragonolobus, Linné.—Countries on the Mediterranean Sea. Though annual, this herb is highly valued for sheep-pastures. The allied *L. siliquosus* (Linné) is perennial, and occurs in a succulent form on sea-coasts.

Lycium Afrum, Linné.—Africa and south-west Asia. Can with many other species be utilized as a hedge-bush.

Lycopodium dendroideum, Michaux.—North America. This, with *L. lucidulum* (Michaux), has become

there a great article of trade, being in request for bouquets and wreaths, and both plants, after having been dyed of various colors, are used as ornaments in vases, etc. (Meehan). These club-mosses are mentioned here to draw attention to similar plants indigenous in this colony, viz. *L. varium*, *L. clavatum*, *L. densum*, *L. laterale*, and *Selaginella uliginosa*.

Lygeum Spartum, Linné.—Regions at the Mediterranean Sea. This perennial grass serves much like the ordinary Esparto grass.

Lyperia crocea, Ecklon.—South Africa. The flowers of this shrub produce a fine orange dye, and are also in use for medicinal purposes.

Maba geminata, R. Brown. — One of the Ebony trees of Queensland. Wood, according to Mr. O'Shanesy, black toward the centre, bright-red toward the bark, close-grained, hard, heavy, elastic, and tough. It takes a high polish, and is recommended for veneers. *Maba fasciculosa*, F. v. M., has the outer wood white and pink. Several other species exist in Queensland, which may likely give good substitutes for ebony-wood.

Marlea Vitiensis, Bentham.—New South Wales and Queensland. A middle-sized tree, generally with a gouty trunk; wood bright-yellow with fine undulating rings, black toward the centre. Fruit edible (P. O'Shanesy),

Marliera glomerata, Bentham. (*Rubachia glomerata*, Berg.)—The Cambuca of sub-tropical Brazil. The fruits attain the size of apricots, and are much used for food (Dr. Rosenthal).

Marliera tomentosa, Cambessedes. — Extra-tropical

Brazil. The Guaparanga. The sweet berries of this tall shrub are of the size of cherries.

Matricaria glabrata, Candolle.—The South African Camomile. This annual herb is there in renown as an excellent substitute for the European camomile (Dr. Pappe).

Maytenus boria, Molina. (*Boaria molinae*, Candolle ; *Maytenus*, *Chilensis*, Candolle.)—Chile. An ever-green tree, assuming, in the northern provinces, considerable dimensions. Wood extremely hard. Cattle and sheep browse, with predilection, on the foliage ; hence the trees are cut down when, in protracted snow-falls or in times of drought, the forage becomes scarce (Dr. Philippi).

Medicago arborea, Linné.—South Europe, particularly Greece. This shrubby, yellow lucerne is of value for dairy farmers, as it much promotes the secretion of milk. This genus includes several other species of pastoral value.

Melia azedarach, Linné. — South Asia, North and also East Australia, and there to far extra-tropical latitudes. As an avenue-tree not without importance, because it will successfully cope with dryness of climate and sterility of soil. It recommends itself also for retaining the foliage till very late in the season, and for producing abundance of fragrant flowers. A black-fruited, similar *Melia* seems as yet little known. The wood is considered of value for some kinds of musical instruments.

Melanthus major, Linné. — South Africa. The leaves of this stately plant are very efficacious as anti-septics, also in cases of scald-head, ring-worm, and various other cutaneous diseases (Dr. Pappe). Its

effect of promoting granulation is very remarkable (Dr. A. Brown).

Melica nutans, Linné.—The Pearl Grass. Europe and North and Middle Asia, enduring an alpine climate, and living also in the shade of forests. It produces suckers, and affords good herbage in woody regions; so also *M. uniflora*. Several other species are on record from various parts of the globe, among which *M. mutica*, of North America, seems to deserve special attention.

Melica ciliata, Linné. — Europe and Middle Asia. A perennial fodder-grass, particularly desirable for sheep.

Melicocca bijuga, Linné. — Central America, on mountains. So many sapindaceous trees of the cupania series have been shown, by my own experiments, to be hardy here that now also this important member of the series could be admitted into this list. The pulp of the fruit is of grape taste; the seeds can be used like sweet chestnuts.

Meriandra Abyssinica, F. v. M. (*M. Benghalensis*, Benth.)—Abyssinia, on high mountains. A shrub of penetrating odor, utilized much like sage.

Mesembryanthemum acinaciforme, Linné. — The Hottentot Fig of South Africa. Under the same vernacular name is also comprised the distinct *M. edule*, L. Both, together with our own *M. æquilaterale*, Haworth, which extends also widely along the American west coast, should be transferred into any of the most inhospitable desert-regions, as they afford in the inner part of their fruit a really palatable and copious food.

Milium effusum, Linné. — English Millet - grass.

Europe, North and Middle Asia, North America. Perennial, suited for damp forest-land particularly, the pastoral capabilities of which it enhances. On river-banks it attains a height of 6 feet. It is relished by cattle. The seeds can be used like millet, the stems for the manufacture of superior straw hats.

Mimosa rubicaulis, Lamarek. — India. A hedge-bush, almost unapproachable. It has proved hardy at the Botanic Garden of Melbourne.

Monarda didyma, Linné. — North America. A perennial, odorous herb, producing the medicinal osnego, or bee-balm tea. *M. punctata*, L., is also of very strong scent, and so *M. fistulosa*, L., with several others.

Monetia barlerioides, P'Heritier. — South Africa. A hedge-shrub.

Moringa pterygosperma, Gaertner. — The Horse-radish-tree of India, abundant into the middle regions of the mountains. The long pods are edible; the seeds are somewhat almond-like, and rich in oil. *M. aptera*, Gaertner, occurs from Abyssinia and Egypt to Arabia and Syria.

Morchella esculent, Persoon. (*M. conica*, Persoon). — Europe, Asia, North and Central America. With *M. semilibera* this Morel has been found in Victoria and New South Wales; its spread should be encouraged by artificial means, as it is a wholesome esculent. European superior species, probably admitting of introduction, are: *M. Gigas*, Pers., *M. deliciosa*, Fries, which extends to Java, *M. patula*, Pers., the Bell-Morel; and several others occur there or in other parts of the globe. Though these fungi show a predilection for pine forests, they are not dependent on them; thus the writer found *M. esculenta* in our Eu-

calyptus forests, and this late in the Autumn. They can all be dried and preserved for culinary purposes.

Morus celtidifolia, Humboldt.—From Peru to Mexico, ascending to 7,000 feet. The fruit also of this Mulberry-tree is edible. *M. insignis*, Planchon, from New Granada, is a similar species.

Myoporum lætum, Forster. — New Zealand, where it is called Ngaio by the aborigines. As a shelter-tree it is equal to our *M. insulare* for the most exposed parts of the coast. It is excellent for shade, and its wood takes a fine polish. It can be raised on the beach from cuttings. Uprooted, it will produce new roots if covered in near the sea. Sheep and horses browse on the foliage.

Myrica cerifera, Linné.—The Wax Myrtle. Sandy sea-coast of North America. This shrub helps to bind the rolling sand; it has fragrant leaves; the fruits are boiled, and the floating wax, which can be converted into candles, is skimmed off.

Myrica cordifolia, Linné. — South Africa. This bushy plant arrests the influx of sea-sand; it also yields, remuneratively, wax from its fruits.

Myrica quercifolia, Linné. — South Africa. This and *M. cordifolia* and the following are the principal wax-bushes there. Many other species from different parts of the globe are available for trial culture, but none has as yet been discovered in Australia.

Myrica serrata, Lamarck. — South Africa. Shrub only about three feet high. The *Myrica* wax is heavier, harder, and more brittle than beeswax, but melts easier. It is obtained from the fruits throughout the cool season. The sowing of seeds is done after the first rain of the cool months has steadied the sand.

The plant can also be multiplied from cuttings. The subterranean trunk is creeping, and in age of considerable length (Dr. Pappe).

Myrrhis odorata, Scopoli. — The Sweet Chervil of Cicely. Mountains of Middle and South Europe, and Asia Minor, particularly in forests. A perennial, aromatic herb, used for salad and culinary condiments. It could here be naturalized in the forests, and would endure the climate of our highest alps; a second species, *M. occidentalis*, Benth., occurs in Oregon.

Myrtus communis, Linné. — The Bridal Myrtle. This bush, of ancient renown, should not be passed; it is industrially in requisition for myrtle wreaths.

Myrtus edulis, Bentham. (*Myrcianthes edulis*, Berg.)—Uruguay. A tree attaining a height of about 25 feet. Berries of $1\frac{1}{2}$ inch diameter, of pleasant taste.

Myrtua Luma, Molina.—South Chile. A tree fully 100 feet high in the virgin forests. Wood very hard and heavy, much sought for press-screws, wheel-spokes, and select implements (Dr. Philippi).

Myrtus Meli, Philippi.—South Chile. Of the same use as the foregoing species, and in this manner most favorably contrasting with the numerous other myrtaceous trees of Chile.

Myrtus nummularia, Poiret.—The Cranberry Myrtle. From Chile to Fuegia; also in the Falkland Islands. This trailing little plant might be transferred to the turfy moors of our alpine mountains. Dr. Hooker describes the berries as fleshy, sweet, and of agreeable flavor. Allied species occur in the cold zone of the Peruvian Andes.

Myrtus tomentosa, Aiton.*—India and China. This

showy shrub ascends to 8,000 feet high. The berries are dark purple, of cherry size, pulpy, and of aromatic sweetness. Various other myrtles, with edible berries, are known from different warm countries.

Nageia (*Podocarpus*) *elongata*, P'Heritier.—South Africa. With *N. Thunbergi*, and with *Erythrina Caffra*, and *Oreodaphne bullata*, this is the tallest tree of Capeland and Caffraria, although it does not advance beyond 70 feet. The yellowish wood is highly valuable, deal-like, not resinous. The stems can be used for top-masts and yards of ships.

Nageia (*Podocarpus*) *andina*, Poeppig. (*Prumnopithys elegans*, Philippi.)—The Lleuque of Chile. A stately tree with clusters of edible, cherry-like fruits. The wood is yellowish and fine-grained, and is chosen for elegant furniture work.

Nageia (*Podocarpus*) *Chilina*, Richard.—The Manniu and Lahual of the Chileans. Height to 100 feet, with corresponding thickness of stem. Wood white, of excellent quality.

Nageia (*Podocarpus*) *elata*, R. Brown.—East Australia. A fine timber-tree of great height.

Nageia (*Podocarpus*) *nubigena*, Lindley.—Southern Chile, generally a companion of *N. Chilina*, with which it agrees in its dimensions and in the utility of its timber.

Nephelium lappaceum, Linné.—India. This tree furnishes the rambutan or rampostan fruit, similar to the litchi and logan fruit. As one species of *Nephelium* is indigenous as far south as Gipps Land, and as all the species seem to require rather a moist, mild forest clime than great atmospheric heat, we may hope to bring also this tree here, in favorable spots, to perfect bearing.

Nageia (*Podocarpus*) *Thunbergii*, Hooker.—South Africa. Superior in the quality of its wood to *N. pruinosa*, *E. Meyer*, and even *N. elongata*; it is bright yellow, fine-grained and very handsome when polished (Dr. Pappe).

Nyssa multiflora, Wangenheim.—Eastern States of North America, where it is called the Forest Tupelo or Black Gum-tree. Wood tough, firm, fine-grained, but very unwedgeable (Dr. Asa Gray). It is used for turners' work. Leaves of deep crimson hue in Autumn. The acidulous fruits are edible.

Nyssa uniflora, Walter.—Eastern States of North America. The Swamp Tupelo. Wood soft, that of the roots very light and spongy, thus used for corks (Dr. Asa Gray). Attains a height of 80 feet. The mucilaginous fruits are edible.

Opuntia Dillenii, Candolle.—Central America. A Tuna-like Cactus, serving for unflammable hedges, and perhaps also for the rearing of the *Coccus* Cacti. It is particularly eligible for barren land.

Opuntia Missouriensis, Candolle.—From Nebraska to New Mexico. Mr. Meehan found this cactus covered with the cochineal coccus, and points to the fact that this insect will live through the intense cold which characterizes the Rocky Mountains to the Colorado regions.

Opuntia Rafinesquii, Engelmann.—North America. The most northern of all species, extending to Lake Michigan.

Osmitopsis asteriscoides, Cassini.—South Africa. A camphor-scented shrub, much in use there for medicinal purposes (Dr. Pappe).

Oxalis esculenta, Otto and Dietrich.—Mexico, there

with *O. tetraphylla*, Cavanilles, *O. Deppei*, Loddiges, *O. violacea*, Linné, and several others producing tuberos, starchy, wholesome roots; the first mentioned gives the largest yield. As similarly useful may be mentioned, among many others: *O. crenata*, Jacquin, from Chile, and *O. enneaphylla*, Cavanilles, from the Falkland Islands and Magellan's Straits.

Pachyma Hoelen, Fries.—China. This large truffle occurs particularly in the province of Souchong. Flavor most agreeable.

Panax papyrifera, F. v. Mueller. (*Arabia papyrifera*, Hooker, *Fatsia papyrifera*, Bentham, *Tetrapanax papyrifera*, C. Koch).—Island of Formosa. The Rice paper-plant, hardy in the lowlands of Victoria, and of scenic effect in garden plantations; the pith furnishes the material for the so-called rice-paper.

Pappea Capensis, Ecklon and Zeyher.—South Africa. The fruit of this tree is of the size of a cherry, savory and edible.

Pandanus furcatus, Roxburgh.—This screw pine occurs in India up to heights of 4,000 feet, according to Mr. S. Kurz; hence it will likely bear our clime, and give us a stately plant for scenic group-planting. *P. pedunculatus*, R. Brown, occurs in East Australia as far south as 32°, and the same or an allied tall species luxuriates in Howe's Island.

Pelargonium odoratissimum, Aiton.—South Asia. A perennial, trailing herb, from the leaves of which a fragrant oil can be distilled. The same remark applies to the shrubby *P. Radula* and *P. capitatum* (Dr. Rosenthal).

Periandra dulcis, Martius. — Sub-tropical Brazil. The sweet root yields liquorice.

Persea Teneriffæ, Poiret (sub *Lauro*). *P. Indica*, Sprengel. — Madeira, Azores, and Canary Islands. This magnificent tree produces a very beautiful, hard, mahogany-like wood, especially sought for superior furniture and turners' work. One of the most hardy trees of the large order of Laurinæ.

Peucedanum Sekakul, Bentham. — Egypt and Syria. Biennial. The root is edible.

Peucedanum cachrydifolium, Ledebour. — Persia. A valuable fodder-herb (Dr. Rosenthal).

Peumus Boldus, Molina. — The Boldo of Chile. A small ornamental evergreen tree, with exceedingly hard wood, which is utilized for many kinds of implements. The bark furnishes dye material. The fruits are of aromatic and sweet taste (Dr. Philippi).

Pisonia aculeata, Linné. — Tropical and sub-tropical countries of both hemispheres, extending as a native plant into New South Wales. This rambling, prickly bush can be chosen for hedge-copses.

Pithecolobium dulce, Bentham. — Mexico. A valuable hedge-plant. The sweet pulp of the pod is wholesome.

Pittosporum tenuifolium, Banks and Solander. — New Zealand. This with *P. eugenioides* has proved exquisite for tall garden-hedges, for which these and several other species were first brought into notice by the writer. Our native *P. undulatum* is rather adapted for copses, and deserves cultivation also for the sake of its fragrant flowers, from which an essential oil can be distilled.

Planera aquatica, Gmelin. — North America. An elm-like tree, which can be chosen for plantations in wet localities.

Plectronia ventosa, Linné.—South Africa. A hedge-bush like *P. ciliata*, Sonder, and *P. spinosa*, Klotzsch.

Poa Abyssinica, Jacquin.—The Teff of Abyssinia. An annual grass. The grain there extensively drawn into use for bread of an agreeable, acidulous taste.

Poa Canadensis, Beauvois.—The Rattlesnake-grass of North-east America. A valuable swamp-grass.

Polygala crotalaroides, Hamilton.—Temperate Himalaya. Praised as an ophidian alexipharmic. To several other species both of the eastern and western hemispheres similar properties are ascribed, but we are almost entirely without any reliable medical testimony on these and many other vegetable antidotes against snake poison.

Polygaster Sampadarius, Fries. — South-eastern Asia. One of the most palatable of all truffles.

Polygonum tinctorium, Loureiro.—Japan and China. An annual herb, deserving attention and local trials here, as yielding a kind of indigo. Its growth would be vigorous.

Prunus ilicifolia, Nuttall. — California. In deep, rich soil, valuable for evergreen hedges of intricate growth.

Prunus Mahaleb, Linné.—Middle and South Europe. It deserves some attention on account of its scented seeds, and also odorous wood, the latter used in turnery for pipes and other articles.

Psidium acidum, Martius.—Higher regions on the Amazon river. A tree, 30 feet high; its guava fruit pale yellow, and of apple size.

Psidium chrysophyllum, F. von Mueller. (*Abbevillea chrysophylla*, Berg.)—The Guabiroba do mato of South Brazil. This tree attains also a height of

about 30 feet. The fruit generally not larger than a cherry. Perhaps other species of the section *Abbevillea* would be hardy here and worthy of cultivation.

Psidium lineatifolium, Persoon. — Mountains of Brazil. Berry about one inch in diameter.

Psidium malifolium, F. v. Mueller. (*Campomanesia malifolia*, Berg.) — Uruguay. Berry about one inch diameter.

Pterocarpus Indicus, Roxburgh. — The Lingo of China and India. A tree of considerable dimensions, famed for its flame-red wood. It furnishes also a kind of dragon-blood resin.

Pterocarpus marsupium, Roxburgh. — India, ascending, in Ceylon and the Circars, to at least 3,000 feet altitude; hence this tree would doubtless grow without protection in those tracts of our colony which are free of frost. It exudes the best medicinal kino, which contains about 75 per cent. of tannic acid. *P. santalinus*, Linné fil., which provides the Saunders, or red sandal-wood, is also indigenous to the mountains of India.

Pterocarya fraxinifolia, Kunth. — Central Asiatic Russia. A kind of walnut-tree, which, with *P. stenoptora*, Cas. de Cand., on Dr. Hance's recommendation, should be adopted as trees for both ornament and timber, and so perhaps also the Japanese species.

Punica granatum, Linné. — The Pomegranate. North Africa and West Asia. Well known for its showy habit, rich-colored flowers, peculiar fruit, and medicinal stringency, but much overlooked regarding its value as a hedge-plant.

Pyrus Japonica, Thunberg. — Japan. One of the prettiest of small hedge-bushes. Under favorable circumstances it will produce its quince-like fruit.

Pyrus nivalis, Jacquin. — The Snow-pear. Middle and South Europe. This would be adapted for orchards in our higher mountain regions. The fruit becomes soft and edible through exposure to snow. *P. amygdaliformis*, Villars, is probably the wild state of this tree.

Pyrus salicifolia, Linné. — Greece, Turkey, Persia, South-west Russia. Though its fruit, which slowly mollifies, is edible, this tree is mainly utilized as a superior stock for grafting.

Quercus densiflora, Hooker and Arnott. — California Chestnut-oak. A large evergreen tree, of beautiful outline, dense foliage, and compact growth. Bark very valuable for tanning; wood, however, subject to rapid decay (Prof. Bolander). *Quercus Douglasi* and *Q. lobata* are two other tall oaks of California.

Quercus lobata, Née. — California. The large acorns can be used for food.

Quercus lyrata, Walter. — The Overcup Oak of the South-eastern States of North America, extending from South Illinois to Florida and Louisiana. Lately recommended as one of the most valuable for timber-plantations.

Quercus phellos, Linné. — The Willow Oak of the Eastern States of North America. The acorns available for food, like those of several other species — for instance, *Q. glabra*, Thunb., of Japan. The comparative value of the numerous cis and trans-atlantic oak is but little as yet understood, either for avenue purposes or timber-plantations, and should be tested with care in botanic gardens. Even recently oaks have been discovered on the mountains of New Guinea.

Raphanus sativus, Linné. — South Asia, up to 16,000

feet in the Himalayas, eastward to Japan. *R. caudatus*, L., the radish, with long, edible pods, is regarded by Dr. Th. Anderson as a mere variety, and he thinks that all sprung from the ordinary *R. Raphanistrum*, L., of Europe.

Rhamnus Græcus, Reuter. — Greece. From this shrub, and to a less extent from the allied *R. prunifolius*, Sibth., are the green-dye berries collected in Greece, according to Dr. Heldreich. These shrubs grow on stony mountains, up to 2,500 feet.

Rhus caustica, Hooker and Arnott. — Chile, where it is called the Litre. A small or middle-sized tree, the very hard wood of which is used for wheel-teeth, axletrees, and select furniture. The plant seems neither caustic nor otherwise poisonous (Dr. Philippi).

Royenia pseudebenus, E. Meyer. — South Africa. Only a small tree, but its wood jet-black, hard and durable; thus, in Capeland and Caffraria, called ebony. *R. pubescens*, Willd., according to Dr. Pappé, furnishes there a wood adapted for xylography. This may give a clue to the adaptability of many other kinds of woods in the large order of Ebenaceæ as substitutes for the Turkish boxwood.

Ruscus aculeatus, Linné. — Middle and South Europe, North Africa, South-west Asia. This odd plant is the only shrubby species of the genus. It serves for forming garden-hedges. The young shoots of this and others are edible.

Rubia peregrina, Linné. — Middle and South Europe, South-west Asia. This perennial species yields also madder-root. Several other kinds deserve comparative test-culture.

Salix Capensis, Thunberg. (*S. Gariiepina*, Bur-

chell.)—South Africa. This willow might be introduced on account of its resemblance to the ordinary weeping willow. *S. daphnoides*, Vill., of Europe and Asia, *S. petiolaris*, Smith, *S. cordata*, Muehlenb., *S. tristis*, Aiton, of North America, are among the best for binding sand. *S. longifolia*, Muehlenb., also North American, is among those which form long, flexible withes.

Salix Humboldtiana, Willdenow.—Through a great part of South America. This willow is of pyramidal habit; attains a height of 50 feet and more. The wood is much in use for yokes and other implements. Many kinds of willow can be grown for consolidating shifting sand-ridges.

Santalum album, Linné.—India, ascending to the temperate elevations of Mysore. A small or middle-sized tree, famed for its fragrant wood and roots. In the drier and stony parts of ranges the greatest fragrance of the wood is generated. *S. Freycenetianum*, Gaudichaud, produces sandal-wood on the mountains of the Sandwich Islands, up to 3,000 feet. Several other species occur in Polynesia. The precious sandal oil is obtained by slow distillation from the heartwood and root, the yield being about $2\frac{1}{2}$ per cent.

Santolina cyparissias, Linné.—Countries near the Mediterranean Sea. A very aromatic and handsome bush, of medicinal value. There are several allied species.

Saxono-Gothæa conspicua, Lindley.—The Mahin of Southern Chile. A middle-sized tree, with fine-grained, yellowish timber.

Sassafras officinale, Hayne.—From Canada to the Gulf of Mexico and the Missouri States. The great-

est height attained by this tree is 50 feet. It furnishes the medicinal sassafras bark and wood, and from this again an essential oil is attainable. The deciduous and often jagged leaves are remarkable among those of Lauraceæ.

Scandix grandiflora, Linné.—Countries around the Mediterranean Sea. An annual herb, much liked there as a salad for its pleasant, aromatic taste.

Scorzonera crocifolia, Sibthorp. — Greece. A perennial herb; the leaves, according to Dr. Heldreich, used there for a favorite salad and spinach.

Scutia Indica, Brogniart.—South Asia. This, on Dr. Cleghorn's recommendation, might be introduced as a thorny hedge-shrub.

Selinum Monnieri, Linné—From East Asia now extending to South Europe, preferring moist places. An annual herb, praised by the Chinese as valuable for medicinal purposes.

Smilax rotundifolia, Linné. — Eastern States of North America, and Canada. A prickly climber with deciduous foliage. An immense local use is made of the roots for the bowls of tobacco-pipes, clay pipes being there almost unknown. It is estimated that nearly three millions of these briar-root pipes are now made a year. The reed portion of these pipes is generally prepared from *Alnus serrulata*, Meehan.

Solanum Fendleri, Asa Gray.—New Mexico. A new kind of potato, enduring a temperature of zero. Mr. Meehan's endeavors to obtain good-sized tubers have as yet not been successful. The following plants are also spoken of by Dr. Rosenthal and others as new kinds of potato, perhaps to be developed through cultivation: *S. demissum*, Lindley, *S. cardiophyllum*,

Lindley, *S. utile*, Klotzsch, *S. verrucosum*, Schlechtendal, *S. Bulbocastanum*, Dunal, *S. stoloniferum*, Schlechtendal, all from Mexico, and some from elevations 10,000 feet high; *S. Maglia*, Molina, from Chile, and *S. immite*, Dunal, from Peru.

Sophora tetraptera, Aiton. Var. *Macnabiana*, Graham.—The Pelu of Chile and Patagonia. A small tree with exceedingly hard and durable wood, much used for cog-wheels and similar structures. The wood differs much from that of *S. toramiro*, of the Easter Island (Dr. Philippi).

Spartina cynosuroides, Willdenow.—Eastern part of North America. A perennial grass of fresh water swamps, there often called prairie-grass; it can be utilized for fodder, and its value as paper material seems equal to that of Esparto.

Spinifex hirsutus, La Billardière.—On the whole coast of extra-tropical Australia. Highly valuable for binding coast-sand with its long, creeping roots.

Spinifex longifolius, R. Brown.—On the tropical and western extra-tropical coast of Australia. Available like the former.

Spinifex squarrosus, Linné.—India. Useful like the two preceding plants. Tennent remarks that the radiating heads become detached when the seed is matured, and are carried by the wind along the sand, over the surface of which they are impelled by their elastic spines, dropping their seeds as they roll along. The heads are so buoyant as to float lightly on water, and while the uppermost spiny rays are acting as sails, they are carried across narrow estuaries to continue the process of embanking beyond on any newly-formed sand-bars.

Spondias dulcis, G. Forster.—Fiji, Tongan, and Society Islands. This noble tree is introduced into this list to indicate that trials should locally be instituted here, as regards the culture of the various good fruit-bearing species of this genus, one of which, *S. pleiogyne*, F. von Mueller, transgresses in East Australia the tropical circle. The lamented Dr. Seemann saw *S. dulcis* 60 feet high, and describes it as laden with fruit of agreeable apple-flavor, called Rewa, and attaining over 11 pounds weight.

Streblus asper, Loureiro.—South Asia. This bears a good recommendation for live fences, it being a shrub of remarkable closeness of branches.

Swietenia Mahagoni, Linné.—The Mahogany-tree of West India. The degree of endurance of this famous tree is not sufficiently ascertained. In its native mountains it ascends to 3,000 feet.

Synoon glandulosum, A de Jussieu. —New South Wales and South Queensland. This evergreen tree deserves cultivation in sheltered, warm, forest-valleys of our colony, on account of its rose-scented wood. Some species of *Dysxylon*, of East Australia, produce also rosewood.

Tagetes glanduligera, Schrank. —South America. This vigorous, annual plant is said by Dr. Prentice to be pulicifugous.

Tamarix articulata, Vahl.—North and Middle Africa, South Asia. Of similar utility as *T. gallica*. The same or an allied species extends to Japan.

Tamarix Germanica, Linné. —Europe and West Asia. Likewise available for arresting the ingress of shifting sand, particularly in moist places; also for solidifying precipitous river-banks.

Tamarix Gallica, Linné.* — South Europe, North and tropical Africa, South Asia. This shrub adapts itself in the most extraordinary manner to the most different localities. It will grow alike in water and the driest soil, and is one of the most grateful and tractable plants in culture. It is readily multiplied from cuttings, which strike root as easily as a willow, and push forth stems with unusual vigor. Hence it is one of the most eligible bushes for planting on coast sand to stay its movements, or for linking embankments.

Taraxacum officinale, Weber. — Dispersed over most of the temperate and cold parts of the globe, but apparently not a native of this part of Australia. This well-known plant is mentioned, as it can be brought under regular cultivation to obtain the medicinal extract from its roots. It is also considered wholesome to pasture animals. The young leaves furnish a medicinal salad.

Tarchonanthus camphoratus, Linné. — South Africa. This bush deserves attention, being of medicinal value. As an odorous garden-plant it is also very acceptable.

Tectona grandis, Linné fil. — The Teak of South Asia. This superb timber-tree has its northern limit in Bandalkhand, at elevations of 2,000 feet, which circumstance may encourage test-culture here.

Terminalia Catappa, Linné. — India, ascending mountain regions. Few trees, as stated by Roxburgh, surpass this in elegance and beauty. We have yet to learn whether it can be naturalized here, which it especially deserves for its nuts. Several species extend in East Australia to sub-tropical latitudes. The seeds

are almond-like, of filbert taste, and wholesome. The astringent fruits of several other species form an article of trade, sought for a lasting black dye. *T. parviflora*, Thwaites, forms a large tree in Ceylon, at elevations up to 4,000 feet.

Tetranthera Californica, Hooker and Arnott.* (*Orcodaphne Californica*, Nees.)—Oregon and California, where it is called the Mountain Laurel or Bay-tree. On the banks of rivers attaining a height of 100 feet, throughout pervaded by a somewhat camphoric odor. Wood hard, close-grained, durable, susceptible of a high polish, easily worked, used for superior flooring, turnery, and manifold other select work. The tree is easily cultivated, and of comparatively quick growth (Dr. Behr and Dr. Bolander).

Tetranthera calophylla, Miquel. (*Cylicodaphne sebifera*, Blume.)—Mountains of Java and the Neilgherries. From the kernels of the berries a tallow-like fat is pressed for the manufacture of candles. The yield is comparatively large. Trial cultures with this tree might be instituted in our humid forest-valleys. *T. laurifolia*, Jacq., of tropical Asia and Australia, and *T. japonica*, Sprengel, are noted as similarly utilitarian.

Thapsia edulis, Bentham. (*Monizia edulis*, Lowe.)—On the island of Deserte grande, near Madeira, where it is called the Carrot-tree. It might be of some use to bring this almost shrubby umbellate to the cliffs of our shores; though the root is inferior to a carrot, perhaps cultivation would improve it.

Theligonum cynocrambe, Linné.—Countries around the Mediterranean Sea. An annual spinach plant of somewhat aperient effect.

Thouarea sarmentosa, Persoon.—Tropical shores of the eastern hemisphere. This curious and tender grass might be easily introduced, to help bind the sand on sea-beaches.

Tilia argentea, Desfontaines.*—The Silver Lime-tree of South-east Europe. The wood is not attacked by boring insects. The flowers are deliciously fragrant, and yield, on distillation, a precious oil.

Tinguarra Sicula, Parlatores.—In the countries at the Mediterranean Sea. The root is edible and celery-like.

Tristania conferta, R. Brown. — New South Wales and Queensland. A noble, shady tree, attaining a height of 150 feet. It is not only eligible as an avenue tree, but also as producing select, lasting timber; ribs of vessels from this tree have lasted unimpaired 30 years and more.

Triticum junceum, Linné.—Europe and North Africa. A rigid grass with pungent-leaves and extensively creeping roots, requiring sea-sand for its permanent growth. One of the best of grasses to keep rolling sand-ridges together, and particularly eligible where cattle and other domestic animals cannot readily be prevented from getting access.

Triphasia Aurantiola, Loureiro. — South-east Asia. This shrub is worth cultivation for the exquisite fragrance of its flowers. The fruits, though small, are of pleasant sweetness. The plant may prove also adapted for hedges. *Glycosmis citrifolia*, Lindley, and *Claussena punctata*, Oliver, also both East Asiatic fruit-shrubs, may possibly show themselves hardy in our sheltered forest-regions.

Tropæolum tuberosum, Ruiz and Pavon. — Peru. The tuberous root serves as an esculent,

Tuber albidum, Fries.—Occurs with *T. æstivum*, but is smaller and less agreeable in taste. The means for transferring truffles and any other edible fungi from one country to another require yet to be further studied and finally devised, but they appear quite feasible.

Tuber magnatum, Pico.—Gray Truffle. South Europe. One of the most esteemed truffles, with some garlic flavor.

Tuber rufum, Pico.—Red Truffle, especially in vineyards. Much used for food, but smaller than the *Terfezia* truffles.

Ulmus crassifolia, Nuttall.—The evergreen Elm of Mexico and Texas.

Ulmus montana, Withering. — The Wych Elm. Europe and extra-tropical Asia. Attains a height of 120 feet.

Ulmus Mexicana, Planchon.—Cordilleras of North America. This elm attains a height of 60 feet, or perhaps more.

Ulmus pedunculata, Fougeraux. (*U. ciliata*, Ehrhart.)—Europe and Asia, through their middle zone. A fine avenue tree.

Ulmus parvifolia, Jacquin.—The evergreen elm of China, Japan, and Queensland. A similar tree is found in the Himalayan mountains.

Vigna lanceolata, Bentham.—Tropical and sub-tropical Australia. Mr. O'Shanesy observes that this twiner produces, along with the ordinary cylindrical pods, others underground from buried flowers, and these somewhat resemble the fruit of *Arachis*. The plant is available for culinary purposes..

Villebrunia integrifolia, Gaudichaud. — India, as-

ascending the Himalayan mountains to 5,000 feet. A small tree, allied to the Ramie-plant, *Behmeria nivea*. Mr. C. Clarke regards the fiber as one of the strongest available in India, it being used for bow-strings. Other *Villebrunias*—for instance, *V. frutescens*, and also some species of *Debregeasia*, particularly *D. velutina*—deserve likewise regular culture, for the sake of their fiber. Moist forest-tracts seem particularly adapted for these plants, because *V. integrifolia* grows in Sikkim at an elevation where, according to Dr. G. King, the rainfall ranges from 100 to 200 inches. The fiber is much more easily separable than that of *Maoutia puya*, according to Dr. King's observations.

Witheringia solanacea, P'Herit. — South America. This perennial herb needs trial-culture, on account of its large edible tubers.

Zelkova crenata, Spach. (*Planera Richardi*, Michaux.) — South-west Asia, ascending to 5,000 feet. In favorable localities a good-sized tree, with qualities resembling those of the elms. The allied *Z. cretica*, Spach, is restricted to South Europe.

Zizyphus lotus, Lamarek. — Countries around the Mediterranean Sea. The fruits are small and less sweet than those of *Z. vulgaris*; nevertheless they are largely used for food in the native country of this bush.

Zizyphus sinensis, Lamarek. — China and Japan. Similar in use to the last.

Zizyphus Spina-Christi, Willdenow. — Middle and North Africa, South-west Asia. Rather a hedge-plant than a fruit-bush.

Zizyphus Joazeiro, Martius. — Brazil. Recommended as yielding fruit in arid regions.

SECOND SUPPLEMENT
TO THE
SELECT PLANTS,
READILY ELIGIBLE FOR
VICTORIAN INDUSTRIAL CULTURE.

BY

Baron Ferd. von Mueller, C.M.G., M. & Ph D., F.R.S.

Acacia Arabica, Willd. — North and Central Africa, Arabia. The stems attain a circumference of 10 feet. The astringent pods are valuable for tanning; the wood, known as "Sunt," is esteemed for planks of boats. *A. gummifera*, Willd., and *A. Ehrenbergiana*, Hayne, are among the species which yield Gum Arabic in North Africa.

Acacia Seyal, Delile. — In the Libyan and Nubian deserts. This thorny tree exudes a good kind of Gum Arabic. It is adapted for the most arid desert country. In any oasis it forms a large and shady tree.

Acacia Verek, Guill. and Perrot. — From Senegambia to Nubia. Affords the best white Gum Arabic of the Nile region, and a large quantity of this commercial article. *A. Etbaica*, Schweinf., from the same region, produces also a good mercantile gum,

Acer dasycarpum, Ehrhart. — Much praised for street-planting; growth comparatively rapid. It produces no suckers, nor is the tree subject to disease. *A. Negundo* is used in California extensively as a shade-tree.

Acer macrophyllum, Pursh. — A beautiful shade-tree; delights on banks of streams. The inner bark can be utilized for baskets and superior mats; the wood is a substitute for hickory.

Acer saccharinum, Wang. — Bears a massive head of foliage on a slender stem. The autumnal coloring is superb. In the eastern States of North America the Sugar Maple is regarded as the best tree for shade avenues. The foliage of *Acer platanoides* assumes, in Autumn, a yellow tint, while that of *A. rubrum* turns red.

Ægiceras majus, Gaertner. — South Asia, Polynesia, North and East Australia. This spurious Mangrove-tree extends far south in New South Wales. It may be employed for staying the off-flow of mud by the tide, and for thus consolidating shores subject to inundation by sea-floods.

Æsculus Hippocastanum, L. — The Horse Chestnut-tree. The wood is free from insects. The tree ascends the Himalayas up to 10,000 feet. A variety occurs with thornless fruits.

Agave Americana, L. — The strength of ropes of this fiber is considerably greater than that of hemp ropes, as well in as out of water. The leaves contain saponin.

Ailanthus glandulosa, L. — Valuable also for reclaiming coast-sands. Wood extremely durable.

Albizzia Julibrissin, Durazzini. — From Persia to

Japan. A favorite ornamental shade Acacia in South Europe.

Aloe dichotoma, L. fil. — Damarara and Namaqua land. This species attains a height of 30 feet, and expands occasionally with its branches so far as to give a circumference of 40 feet. The stem is remarkably smooth, with a girth sometimes of 12 feet. It is a yellow-flowering species. *A. Bainesii*, Baker & Dyer, is almost as gigantic as the foregoing. Both doubtless yield medical gum-resin like many others. *A. Barberæ*, which is closely related to *A. Zeyheri*, attains, in Caffraria, a height of 40 feet, with a stem 16 feet in circumference at 3 feet from the ground.

Andropogon argenteus, Candolle.—Pronounced by Leybold to be one of the best fodder-grasses of the Cordilleras of Chile.

Andropogon pertusus, Willd.—South Asia, tropical and sub-tropical Australia. Perennial. Mr. Nixon, of Benalla, regards it one of the best grasses to withstand long droughts, while it will bear any amount of feeding. *A. Halepensis* (recorded before) yields a very large hay-crop for mowing, as it may be cut half-a-dozen times in a season, should the land be rich. All kinds of stock have a predilection for this grass. It will mat the soil with its deep and spreading roots; hence it should be kept from cultivated fields.

Andropogon saccharatus, Roxburgh.—The stem can be used as a culinary vegetable.

Andropogon sorghum, Brotero.—The panicles are used for carpet-brooms, the fibrous roots for velvet-brushes. A kind of beer called "Merisa" is prepared from the seeds,

Aponogeton crispus, Thunberg. — From India to New South Wales. The tuberous roots of this water-herb are amylaceous and of excellent taste, though not large. The same remarks apply to *A. monostachyus*, L. fil.

Aquilaria Agallocha, Roxburgh. — On the mountains of Silhet and Assam. A tree of immense size, probably hardy in our warm forest-valleys. It furnishes the fragrant Calambac or Agallochum wood, known also as Aggur or Tuggur or the Aloe-wood of commerce, famed since ancient times. The odorous portion is only partially distributed through the stem. This wood is also of medicinal value.

Aristotelia Macqui, P'Heritier. — Chile. The berries of this shrub, though small, have the pleasant taste of bilberries, and are largely consumed in Chile. The plant would thrive in our forest-valleys.

Avicennia officinalis, Linné. — From the coasts of South Asia to those of South Africa, all Australia and New Zealand. It is proposed by Dr. Herm. Behr to plant this tree for consolidating muddy tidal shores.

Berberis buxifolia, Lamarek. — From Magellan's Straits to Chile. This bush, according to Dr. Philippi, is the best among the South American species for berries, which are comparatively large, black, hardly acid, but slightly astringent. In Valdivia and Chiloe they are frequently consumed.

Brachychiton acerifolium, F. v. Mueller. — The East Australian Flame-tree. An evergreen shade-tree, with magnificent trusses of crimson blossoms. Like *B. populneum*, R. Br., eligible for promenade-lines, when celerity of growth is no object. The mucilaginous sap, when exuded, indurates to a kind of Tragacanth.

Cæsalpinia brevifolia, Bentham.—Chile. The pods of this shrub are extraordinarily rich in tannic acid, and hence valuable for tanneries (Philippi).

Cajanus Indicus, Candolle.—Indigenous also to tropical Africa. Attains a height of 15 feet, and has yielded in the richest soil of Egypt 4,000 lbs. of peas to the acre. A crop is already obtained in the first year. The seeds can be used as peas in the green as well as mature state.

Carex Moorcroftiana, Falconer.—The Loongmur of the Alps of Thibet. One of the best of sedges for staying the shifting sand by its deeply-penetrating and creeping roots. It forms an intricate network on the surface and beneath; outliving most other fodder-plants at its native places, in the season it becomes available for cattle and horse-food, particularly in the cold of Winter, and is held to be singularly invigorating to pasture-animals.

Cereus Quixo, Gay.—Chile. This stately cactus attains a height of 15 feet, and is one of the hardiest species. The charming snow-white flowers are followed by sweetish, mucilaginous fruits, available for the table (Dr. Philippi). *C. giganteus*, Engelmann, from New Mexico, which attains the stupendous height of 50 feet, with a proportionate columnar thickness; yields also edible fruits, and lives unprotected in our clime. It was introduced by the writer many years ago.

Citrus Aurantium, Linné.—In Central India a peculiar variety is under culture, producing two crops a year. The blossoms of February and March yield their ripe fruit in November and December, whereas from the flowers of July mature fruits are obtained in

March and April. To prevent exhaustion only alternate fruiting is allowed.

Copernicia cerifera, Martius. — Brazil. This magnificent Fan-Palm, like so many others of this noble order, may prove hardy in our latitudes. The stem furnishes starch, the sap yields sugar, the fibers of the leaves are converted into ropes, which resist decay in water, and can also be used for mats, hats, baskets, and brooms, and many other articles are prepared from the leaves. The inner part of the leaf-stalks serves as a substitute for cork. Mainly, however, this palm is valued for its Carnauba-wax. Each tree furnishes about four pounds annually. In 1862, no less than 2,500,000 pounds were imported into Great Britain, realizing about £100,000.

Cryptomeria Japonica, Don. — In the Azores, preferred even to the *Pinus Halepensis* for timber culture, on account of its still more rapid growth in that insular clime.

Cupressus macrocarpa, Hartw. — California, from Monterey to Noyo, in the granite as well as sandstone formation, sometimes in Sphagnum moors. Attains a height of 50 feet. One of the best shelter-trees on sea-sands, naturally following the coast-line, never extending many miles from the shores, and occurring in localities where the temperature does not rise above 80° F., nor sink below the freezing point (Bolander).

Cupressus Nutkænsis, Lamb. — The Yellow Cedar or Cypress of Alaska and the neighboring States. Timber hard, durable, tough, and close, also scented; worked with ease. Can be trimmed for hedge-growth.

Cycas Normanbyana, F. v. Mueller. — Another noble Queensland species, deserving introduction, and ca-

pable of being shipped to long distances in an upgrown state without emballage.

Dammara Australis, Lamb.—The wood is straight-grained, and much in use for boats, superior furniture, casks, and particularly sought for decks of ships, lasting for the latter purpose twice as long as the deal of many other pines. It is also available for railway brake-blocks and for carriages, and regarded as one of the most durable among timber of the coniferæ.

Diposis Bulbocastanum, Candolle. — Chile. The tubers of this perennial herb are edible (Philippi).

Eucalyptus diversicolor, F. v. Mueller.—Furnishes good timber for ship and boat-planks, particularly for masts, likewise for wheels. Rich soil serves this and other rapid-growing species best, although they live in inferior soil.

Eucalyptus gomphocephala, Cand.—Attains a height of 120 feet, the clear trunk up to 50 feet long. All the Eucalypts are valuable for the production of tar, pitch, acetic acid, potash, and various dye-substances.

Eucalyptus marginata, Smith. — Instances are on record of the stem having attained a girth of 60 feet at 6 feet from the ground, through the formation of buttresses.

Eugenia myrtifolia, Sims. — East Australia. A handsome bush with palatable fruits.

Fagopyrum cymosum, Meissner. — This and some allied species are utilized for obtaining a blue dye; they also serve for spinach.

Fraxinus Chinensis, Roxburgh.—It is this Ash on which a peculiar wax is produced by *Coccus Pela*, perhaps also on some species of *Ligustrum*. About 40,000 pounds are exported annually, according to

Mr. Bernardini. *F. ornus* is well adapted for a promenade-tree, and is earlier in foliage than *F. excelsior*, *F. Americana*, and most other ash-trees.

Hibiscus cannabinus, Linné. — Stems up to 12 feet high, without ramification, if closely sown. Rich soil on the Nile has yielded over 3,000 pounds of clear fiber in one harvest. The bearing strength is often found to be more than of the Sunn-fiber.

Lupinus arboreus, Sims. * — South America. This and another somewhat shrubby species, namely *L. albiflorus*, Bentham, of California, have been used there for the reclamation of sand, on account of their long tap-roots, the latter having been traced to depths of 25 feet, while the stems were only 3 feet high. The germination is easy and the growth rapid on the sand-dunes. For aiding the young Lupins, for the first two months, to get hold of the sand, barley is sown with them, as the latter sprouts in a few days and holds the sand in the second week; the Lupin subsequently covers the sand with a dense vegetation in less than a year.

Maclura aurantiaca, Nuttall. — It resists severe frosts. The saplings furnish stakes for vines, which are very lasting. The wood serves well for bows, buggy-shafts, carriage-poles, and similar articles. The root yields an excellent dye. *M. tinctoria*, D. Don, which furnishes the fustic-wood of Central and South America, may prove hardy here.

Medicago lupulina, Linné. — The Black Medick. Europe, Asia, and North America. An annual or biennial pasture-herb, easily grown, and not without nutritive importance. A variety of *M. sativa* (*M. media*, Pers.), deserves preference for sand-tracts.

Melilotus cœrulea, Lamarek. — South Europe and North Africa. An annual, very odorous fodder-herb. It forms an ingredient of the green Swiss cheese, which owes its flavor and color chiefly to this plant.

Morus alba, Linné.—The muscardine disease is produced by *Botrytis Bassiana*, while the still more terrible febrine disease is caused by a minute vibriolike organism. Countries like ours, happily free of these pests, can thus rear healthy silk - ova at a high premium for exportation.

Musa simiarum, Rumph. (*M. corniculata*, Lour.; *M. acuminata*, Coll.) — From Malacca to the Sunda Islands. About half a hundred marked varieties of this species, called mainly Peesangs in India, are under cultivation there, especially on the Archipelagus, while *M. sapientum* occurs wild more frequently on the mainland. Though the latter is principally cultivated on the Indian continent, yet it never equals in delicacy the cultivated forms of *M. simiarum*, the fruit of which sometimes attains a length of 2 feet (Kurz).

Myrtus acmenoides, F. v. Mueller. — Queensland. The fragrant leaves of this and of *M. fragrantissima* used for flavoring tea, according to Mr. P. O'Shanesy.

Panicum brizanthum, Hochstetter. — From Abyssinia to Nepal. A large-grained, perennial Millet-grass.

Panicum latissimum, Mikan. — Brazil. A highly-ornamental grass. Leaves extremely broad, but hard; panicle very rich.

Panicum turgidum, Forskael. — Egypt, where this millet yields a bread-grain. *P. brizanthum*, Hochst.,

is a large-grained perennial millet from Abyssinia and Nepaul.

Panicum virgatum, Linné.—North America, South Asia, and North Australia. A tall perennial species, with a wide, nutritious panicle.

Papophorum commune, F. v. Mueller. — Widely dispersed over the continent of Australia; also in some parts of Asia and Africa. Perennial; regarded as a very fattening pasture-grass, and available for arid localities.

Pinus contorta, Dougl. (*P. Bolandri*, Parlatores.)—Also abundant on the mountains of Colorado, and very eligible for clothing rocky hill-sides (Meehan). In California it forms dense thickets along the coast, and is, in this respect, as valuable as *P. Laricio*, *P. pinaster*, and *P. Halepensis* in Europe.

Pinus Douglasii, Sabine. — Called also the Yellow Pine of Puget Sound, where it yields the principal timber for export, and is therefore of great commercial value in the lumber-trade. The maximum height known is 400 feet; the greatest diameter of the stem 14 feet. The timber is fine and clear-grained, splendid for masts and spars, also for flooring, being for that purpose regarded as the best of California woods (Bollander). It is the strongest wood on the North Pacific coast, both in horizontal strain and perpendicular pressure. Sub-alpine localities here should be extensively planted with this famous tree. It requires deep and rich soil, but likes shelter; its growth at the rate of the larch, and passes in various localities as black and red spruce. *P. Lambertiana* yields also much of the flooring-wood of California.

Pinus edulis, Engelmann.—The Nut Pine of New

Mexico. Thrives best on dry limestone soil. Greatest height 80 feet. *P. rigida* is content with the driest localities, nor is it readily susceptible to injury from fire.

Pinus flexilis, James. — The White Pine of the Rocky Mountains, from New Mexico to British Columbia, ascending to 12,000 feet. A valuable fir for cold regions. It attains a height of 100 feet. Wood pale and compact. *P. radiata* can be utilized for obtaining tar and pitch. It bears exposure to the sea at the very edge of the coast.

Pinus Halepensis, Mill. — Although ascending mountains in South Europe to the height of 4,000 feet, it thrives best in loose sand-coasts, where, in ten years, it will attain to 25 feet, and finally will become a larger tree than on firm lands. We find the Aleppo-fir one of our best avenue-trees, as here first proved by the writer.

Pinus Strobus, Linné. — Particularly adapted for deep, rich soil in mountain valleys; known to reach a height of 270 feet and a stem of 8 feet diameter. The wood is much sought, among other purposes, for flooring, oars, etc.

Platanus occidentalis, Linné. — Its wood is not readily attacked by insects. It has been successfully planted in morassy places, to cope with miasmatic effluvia.

Platanus orientalis, Linné. — It resists, in large towns, such as London, the smoke better than any other tree, growing even under such disadvantages vigorously.

Platanus recemosa, Nutt. — A good promenade-tree, which, according to Professor Bolander, grows more rapidly and more compactly than *P. occidentalis*.

Poa aquatica, Linné. — It produces a large bulk of foliage, and may be disseminated in swamps for fodder purposes.

Poa demoralis, Linné. — According to Lawson no better grass exists for displacing weeds on pleasure-lawns; the same may be said of *Poa compressa*, L.

Populus monilifera, Aiton. — It is recommended to obtain, for planting along streets or near dwellings, only cuttings from male trees, as the minute, downy seeds of the female trees are copiously wafted through the air, and have irritant effects on the respiratory organs.

Priva lævis, Jussieu. — Chile and the Argentine Republic. A perennial herb, the small tubers of which can be used for food (Philippi).

Quillaja saponaria, Molina. — Chile. A colossal tree. The bark is rich in saponin, and thus valuable for dressing wool and silk.

Rheum officinale, Baillon. — Western China and Eastern Thibet, on the high table-land. It furnishes the most of the true Turkey rhubarb, not merely from the root, but also from the woody stem. Suited for our alps.

Rubus geoides, Smith. — Falkland Islands, Fuegia, Patagonia, and Chiloe. A herbaceous kind of raspberry-plant, with greenish-yellow fruits, resembling the cloud-berry, and of a very agreeable taste. Best adapted for our alps.

Rubus rosifolius, Smith. — Tropical and sub-tropical regions of Africa and Asia; also throughout the littoral forests of East Australia. This shrub bears, in woody regions, an abundance of fruits, of large size, and these early and long in the season.

Rubus rugosus, Smith. — South Asia. The fruit, which ripens here all the year round, is nearly twice the size of the ordinary blackberry.

Salix alba, Linné. — With other large willows and poplars one of the best scavengers for back yards, where drainage cannot readily be applied ; highly valuable also for forming lines along narrow water-courses or valleys in forests, to stay bush-fires. The charcoal excellent for gunpowder. The wood in demand for matches.

Secale creticum, Linné. — Though probably only a variety of *S. cereale*, L., it deserves specially to be mentioned as furnishing a bread of peculiar taste.

Sequoia sempervirens, Endl. — Furnishes the red deal of California. Measurements up to 360 feet are on record. Its growth is about 32 feet in 16 years. Often found on metamorphic sandstone.

Sequoia Wellingtonia, Seemann. — Traditional accounts seem to have overrated the height of the mammoth tree. In the Calaveras grove two of the largest trees, which may have been the tallest of all, were destroyed ; the two highest now existing there are respectively 325 and 319 feet high, with a circumference of 45 and 40 feet at 6 feet from the ground. At the Mariposa grove the highest really measured trees are 272, 270, and 260 feet high, but one of these has the enormous circumference of 67 feet at 6 feet from the ground ; while another, the height of which is not recorded, is 93 feet in girth at the ground, and 64 feet at 11 feet from it. The branches of this individual tree are as thick as the stems of large elms. The height of the Calaveras grove is 4,760 feet above sea-level.

Sesbania cannabina, Persoon. — South Asia. An annual herb of easy growth in wet localities, requiring less attention in weeding and otherwise than the Jute plant. The crop for fiber ripens in about five months.

Taxus baccata, Linné. — It should be kept out of the reach of pasture-animals, as leaves and berries are deadly poisonous.

Thea Chinensis, Sims. (*Camellia thiefora*, Griff.) — The very troublesome tea-bug of Asia is *Helopeltis theivora*. Fumigation and the application of bird-lime are among the remedies to cope with this insect. The third volume of the *Agricultural and Horticultural Society of India* is mainly occupied by Lieut.-Colonel Edw. Money's and Mr. Watson's elaborate essays on the cultivation and manufacture of tea in India.

Thuja gigantea, Nuttall. — The Oregon White Cedar; wood susceptible of high polish. The diameter of the stem attains 10 feet, or even more. The timber is light. Canoes carrying over four tons have been obtained out of one stem. The bast can be converted into ropes and mats.

Thuja occidentalis, Linné. — Northern White Cedar. It prefers moist soil. Valuable for hedge-copses; it can also be trained into garden-bowers.

Tripsacum dactyloides, Linné. — Serves for binding sand. The seeds are available for food.

Tropæolum sessilifolium, Pœppig. — Chile. Among the species of this genus one of the most eligible for its tubers, which can be consumed even in a raw state, and are larger than those of most other *Tropæolums*, while the stems are short and procumbent (Philippi).

Vaccinium præstans, Rudolphi. — Kamtchatka. A

minute plant, but with large, delicious fruits. It might easily be disseminated on our alps.

Vitis vinifera, Linné.—It might be worthy of trial how far the grape-vines can be grafted on such other species of the extensive genus *Vitis* as may not be attacked by the destructive *Pemphigus* or *Phylloxera*.

Vitis vulpina, Linné.—Extends also to Japan, Manchuria, and the Himalayas. The Catawba grape, according to Mr. Meehan, does not belong to this species, but descended from *V. Labrusca*, or *V. æstivalis*. The Clinton and Elsinboro grapes, according to this eminent American horticulturist, seem to have had their origin with *V. cordifolia* and *V. riparia*. *V. Labrusca* extends also to the Himalayas. Dr. Planchon's important memoir, *Les Vignes Americaines*, published in 1875, should be consulted in reference to American grapes.

Zizyphus Jujuba, Linné.—Occurs also in East Australia, to sub-tropic latitudes, and likewise in various parts of Africa. It attains a height of 40 feet.

GEOGRAPHICAL INDEX.

NORTHERN AND MIDDLE EUROPE.

Acer campestre, *A. platanoides*, *A. Pseudo-platanus*, *Achillea atrata*, *A. Millefolium*, *A. moschata*, *A. nana*, *Aconitum Napellus*, *Acorus Calamus*, *Actæa picata*, *Agaricus auricula*, *A. cæsareus*, *A. Cardarella*, *A. deliciosus*, *A. eryngii*, *A. esculentus*, *A. extinctorius*, *A. giganteus*, *A. Marzuolus*, *A. melleus*, *A. mouceron*, *A. odorus*, *A. oreades*, *A. socialis*, *A. splendens*, *Agrostis alba*, *A. rubra*, *Aira cæspitosa*, *Allium Schœnoprasum*, *A. Scorodoprasum*, *Alnus glutinosa*, *A. incana*, *Alopecurus pratensis*, *Althæa officinalis*, *Anemone pulsatilla*, *Anthemis nobilis*, *A. tinctoria*, *Archangelica officinalis*, *Arctostaphylos uva-ursi*, *Arnica montana*, *Artemisia Absinthium*, *A. Mutellina*, *A. Pontica*, *Asparagus officinalis*, *Atropa Belladonna*, *Avena elatior*, *A. fatua*, *A. flavescens*, *A. pubescens*, *A. sativa*, *Beta vulgaris*, *Betula alba*, *Brassica alba*, *B. Napus*, *B. nigra*, *B. oleracea*, *B. Rapa*, *Calamintha officinalis*, *Camelina sativa*, *Carex arenaria*, *Carpinus Betulus*, *Carum Bulbocastanum*, *C. Carui*, *C. segetum*, *Chæromyces meandriformis*, *Chærophyllum bulbosum*, *C. sativum*, *Cichorium Intybus*, *Cochlearia Armoracia*, *C. officinalis*, *Colchicum autumnale*, *Conium maculatum*, *Corylus Avellana*, *Crambe maritima*, *Cra-*

tægus *Oryacantha*, *Cynosurus cristatus*, *Cytisus scoparius*, *Dactylis glomerata*, *Daucus Carota*, *Digitalis purpurea*, *Dipsacus fullonum*, *Elymus arenarius*, *Fagus silvatica*, *Festuca arundinacea*, *F. drymeia*, *F. duriuscula*, *F. elatior*, *F. gigantea*, *F. heterophylla*, *F. loliacea*, *F. ovina*, *F. pratensis*, *F. rubra*, *F. silvatica*, *F. spadicea*, *Fragaria collina*, *F. vesca*, *Fraxinus excelsior*, *Gentiana lutea*, *Helleborus niger*, *Holcus lanatus*, *H. mollis*, *Hordeum secalinum*, *Humulus Lupulus*, *Hydnum album*, *H. auriscalpium*, *H. Caput-Medusæ*, *H. coralloides*, *H. diversidens*, *H. erinaecium*, *H. fulgineo-album*, *H. graveolens*, *H. Hystrix*, *H. imbricatum*, *H. infundibulum*, *H. lævigatum*, *H. subsquamosum*, *H. violascens*, *Hyoscyamus niger*, *Ilex aquifolium*, *Inula Helenium*, *Juniperus communis*, *Lactuca virosa*, *Laserpitium aquilegium*, *Lathyrus pratensis*, *L. sativus*, *Lavatera arborea*, *Leersia oryzoides*, *Lolium perenne*, *Lotus corniculatus*, *L. major*, *Marrubium vulgare*, *Matricaria Chamomilla*, *Medicago falcata*, *M. sativa*, *Melica ciliata*, *M. nutans*, *M. uniflora*, *Melilotus alba*, *M. officinalis*, *Mentha citrata*, *M. crispa*, *M. piperita*, *M. Pulegium*, *M. rotundifolia*, *M. silvestris*, *M. viridis*, *Menyanthes trifoliata*, *Milium effusum*, *Morchella deliciosa*, *M. esculenta*, *M. Gigas*, *M. patula*, *Onobrychis sativa*, *Origanum vulgare*, *Peucedanum officinale*, *P. Ostruthium*, *P. sativum*, *Phleum alpinum*, *P. pratense*, *Physalis Alkekengi*, *Pimpinella Saxifraga*, *Pinus Abies*, *P. Cembra*, *P. Larix*, *P. montana*, *P. Picea*, *P. silvestris*, *Poa angustifolia*, *P. aquatica*, *P. distans*, *P. fluitans*, *P. maritima*, *P. nemoralis*, *P. pratensis*, *P. trivialis*, *Populus alba*, *P. canescens*, *P. dilatata*, *P. fastigiata*, *P. nigra*, *P. tremula*, *Prunus Mehaleb*, *P. spinosa*,

Psamma arenaria, *P. Baltica*, *Pyrus Germanica*, *P. nivalis*, *Quercus Robur*, *Reseda Luteola*, *Rhamnus catharticus*, *Ribes Grossularia*, *R. nigrum*, *R. rubrum*, *Rosa Gallica*, *Rubia peregrina*, *Rubus cæsius*, *R. Chamæmorus*, *R. fruticosus*, *R. Idæus*, *Rumex Acetosa*, *R. scutatus*, *Ruscus aculeatus*, *Salix alba*, *S. caprea*, *S. daphnoides*, *S. fragilis*, *S. lanceolata*, *S. purpurea*, *S. rubra*, *S. triandra*, *S. viminalis*, *Sambucus nigra*, *Saponaria officinalis*, *Scorzonera Hispanica*, *Sison amomum*, *Smyrniolum Olusatrum*, *Solanum Dulcamara*, *Tanacetum vulgare*, *Taraxacum officinale*, *Tilia Europæa*, *Tragopogon porrifolius*, *Trapa natans*, *Trifolium agrarium*, *T. fragiferum*, *T. hybridum*, *T. incarnatum*, *T. medium*, *T. pratense*, *T. repens*, *Triticum junceum*, *Tuber æstivum*, *T. albidum*, *T. cibarium*, *T. magnatum*, *T. melanosporum*, *Ulmus campestris*, *U. pedunculata*, *Vaccinium Myrtillus*, *V. Oxycoccus*, *V. uliginosum*, *V. Vitis-Idæa*, *Valeriana Celtica*, *Valerianella olitoria*, *Veratrum album*, *Vicia sativa*, *Viola odorata*.

COUNTRIES AT OR NEAR THE MEDITERRANEAN SEA.

Acacia Arabica, *A. Seyal*, *A. tortilis*, *A. Verek*, *Acer Creticum*, *Achillea fragrantissima*, *Ægilops ovata*, *Æsculus Hippocastanum*, *Agaricus cæsareus*, *Agrostis alba*, *Aira cæspitosa*, *Alkanna tinctoria*, *Allium Ascallonicum*, *A. Cæpa*, *A. Neapolitanum*, *A. Porrum*, *A. roseum*, *A. Scorodoprasum*, *A. sativum*, *Aloe vulgaris*, *Alopecurus pratensis*, *Althæa officinalis*, *Amarantus Blitum*, *Anacyclus Pyrethrum*, *Andropogon Halepensis*, *A. Schoenanthus*, *Anthemis nobilis*, *A. tinctoria*, *Anthoxanthum odoratum*, *Apium*

graveolens, Argania Sideroxylon, Artemisia Absinthium, A. Pontica, Arundo Ampelodesmos, A. Donax, A. Pliniana, Asparagus acutifolius, A. aphyllus, A. horridus, A. officinalis, Astragalus Cephalonicus, A. Creticus, A. gummifer, A. Parnassi, A. strobiliferus, A. verus, Atropa Belladonna, Avena elatior, A. fatua, A. flavescens, A. pubescens, A. sativa, Balsamodendron Ehrenbergii, B. Mukul; B. Opobalsamum, Beta vulgaris, Betula alba, Bongardia Rouwolfii, Borrago officinalis, Brassica alba, B. campestris, B. Cretica, B. juncea, B. Napus, B. nigra, B. oleracea, B. Rapa, Buxus Balearica, B. longifolia, B. sempervirens, Cajanus Indicus, Calamintha Nepeta, C. officinalis, Callitris quadrivalvis, Camelina sativa, Cannabis sativa, Capparis spinosa, Carpinus Betulus, Carthamus tinctorius, Carum Bulbocastanum, C. Carui, C. ferulifolium, C. Petroselinum, C. segetum, Cassia acutifolia, C. angustifolia, C. obovata, Castanea sativa, Catha edulis, Cedronella triphylla, Celtis Australis, Ceratonia Siliqua, Chærophyllum bulbosum, C. Sativum, Chamærops humilis, Chelidonium majus, Chenopodium blitum, Crysanthemum carneum, C. roseum, Cicer arietinum, Cichorium Endivia, C. Intybus, Cistus Creticus, C. Cyprius, Cochlearia Armoracia, Coffea Arabica, Colchicum autumnale, Colocasia antiquorum, Conium maculatum, Conopodium denudatum, Convolvulus floridus, C. Scammonia, C. scoparius, Coriandrum sativum, Corylus Colurna, Corynosicyos edulis, Crambe cordifolia, C. Klotschyana, C. maritima, C. Tataria, Cratægus Azarolus, C. Oxyacantha, C. pyracantha, Crithmum maritimum, Crocus sativus, C. serotinus, Crozophora tinctoria, Cucumis Citrullus, C. Colocynthis, C. Melo, C. sativus, Cucurbita maxima, C.

Melopepo, *C. moschata*, *C. Pepo*, *Cuminum Cyminum*, *C. Hispanicum*, *Cupressus sempervirens*, *Cynara Cardunculus*, *C. Scolymus*, *Cynodon Dactylon*, *Cynosurus cristatus*, *Cyperus esculentus*, *C. Papyrus*, *C. Syriacus*, *Cytisus scoparius*, *Dactylis glomerata*, *Daphne Mezereum*, *Daucus Carota*, *Digitalis purpurea*, *Diospyros Lotus*, *Dipsacus fullonum*, *Dolichos Lablab*, *D. uniflorus*, *Dracocephalum Moldavica*, *Ecballion Elaterium*, *Eleusine flagellifera*, *E. Tocussa*, *Elymus arenarius*, *Ervum Lens*, *Fagopyrum esculentum*, *F. Tataricum*, *Fagus silvatica*, *Ferula longifolia*, *Festuca elatior*, *F. gigantea*, *F. ovina*, *F. silvatica*, *Ficus Carica*, *F. Sycamorus*, *Fœniculum officinale*, *Fragaria collina*, *F. pratensis*, *F. vesca*, *Fraxinus excelsior*, *F. Ornus*, *Genista monosperma*, *G. sphærocarpa*, *Gentiana lutea*, *Glycyrrhiza echinata*, *G. glabra*, *Gossypium arboreum*, *Guilandina Bonduc*, *G. Bonducella*, *Hedysarum coronarium*, *Helichrysum orientale*, *Helleborus niger*, *Holeus lanatus*, *H. mollis*, *Hordeum deficiens*, *H. distichon*, *H. hexastichon*, *H. macrolepis*, *H. secalinum*, *H. vulgare*, *H. zeocriton*, *Humulus Lupulus*, *Hydnum imbricatum*, *Hyoseyamus niger*, *Hyphæne Argun*, *H. coriacea*, *Indigofera argentea*, *Inula Helenium*, *Isatis tinctoria*, *Jasminum odoratissimum*, *J. officinale*, *Juglans regia*, *Juniperus brevifolia*, *J. Cedrus*, *J. drupacea*, *J. excelsa*, *J. foetidissima*, *J. Phœnicea*, *J. procera*, *Koeleria cristata*, *K. glauca*, *Lactuca virosa*, *Lathyrus pratensis*, *L. tuberosus*, *Laserpitium aquilegium*, *Laurus nobilis*, *Lavandula angustifolia*, *L. latifolia*, *L. Stœchas*, *Lavatera arboorea*, *Lawsonia alba*, *Leersia oryzoides*, *Lepidium sativum*, *Linum usitatissimum*, *Liquidambar Altingia*, *L. orientalis*, *Lolium Italicum*, *L. perenne*, *Lotus cor-*

niculatus, *L. major*, *L. siliquosus*, *L. tetragonolobus*,
Lupinus albus, *L. luteus*, *L. varius*, *Lycium Afrum*,
Lygeum Spartum, *Marrubium vulgare*, *Matricaria*
Chamomilla, *Medicago arborea*, *M. lupulina*, *M. me-*
dia, *M. sativa*, *Melica ciliata*, *M. nutans*, *M. uniflora*,
Melilotus alba, *M. cœrulea*, *M. macrorrhiza*, *M. officina-*
lis, *Melissa officinalis*, *Mentha citrata*, *M. crispa*,
M. Piperita, *M. Pulegium*, *M. rotundifolia*, *M. Silvestris*,
M. viridis, *Menyanthes trifoliata*, *Meriandra*
Abyssinica, *Milium effusum*, *Morchella deliciosa*, *M.*
esculenta, *Moringa aptera*, *Morus nigra*, *Musa Ensete*,
M. Livingstoniana, *Myrica Faya*, *Myrrhis odorata*,
Myrtus communis, *Nelumbo nucifera*, *Nicotiana Per-*
sica, *Ocimum Basilicum*, *O. sanctum*, *O. suave*, *Olea*
Europæa, *Onobrychis sativa*, *Origanum Dictamnus*,
O. hirtum, *O. Majorana*, *O. Mara*, *O. normale*, *O.*
Onites, *O. virens*, *O. vulgare*, *Ornithopus sativus*, *O-*
strya carpinifolia, *Oxytenanthera Abyssinica*, *Paliurus*
Spina-Christi, *Panicum brizanthemum*, *P. Crus-Galli*,
P. glabrum, *P. maximum*, *P. prostratum*, *P. repens*,
P. sanguinale, *P. spectabile*, *P. turgidum*, *Papaver*
somniferum, *Pennisetum thyphoideum*, *Persea Ten-*
eriffe, *Peucedanum cœchrydifolium*, *P. officinale*,
Phalaris brachystachys, *P. Canariensis*, *P. minor*, *P.*
truncata, *Phaseolus coccineus*, *Phleum alpium*, *P. pra-*
tense, *Phoenix dactylifera*, *Physalis Alkekengi*, *P. an-*
galata, *Pimpinella Anisum*, *P. magna*, *P. nigra*, *P.*
Saxifraga, *P. Sisarum*, *Pinus Abies*, *P. Canariensis*,
P. Cedrus, *P. Cembra*, *P. cilicica*, *P. Haleppensis*, *P.*
Laricio, *P. Larix*, *P. montana*, *P. orientalis*, *P. Pin-*
aster, *P. Pinsapo*, *P. Pyrenaica*, *Pistacia Atlantica*,
P. Lentiscus, *P. Terebinthus*, *P. vera*, *Peucedanum*
sativum, *Platanus orientalis*, *Poa Abyssinica*, *P. an-*

gustifolia, *P. aquatica*, *P. cynosuroides*, *P. distans*,
P. fluitans, *P. maritima*, *P. nemoralis*, *P. trivialis*,
Populus alba, *P. canescens*, *P. dilatata*, *P. fastigiata*,
P. nigra, *P. tremula*, *Prosopis Stephaniana*, *Prunus*
Amygdalus, *P. Armenica*, *P. avium*, *P. Cerasus*, *P.*
domestica, *P. Lauro-Cerasus*, *P. Mahaleb*, *P. Padus*,
P. Persica, *P. spinosa*, *Psamma arenaria*, *Punica*
granatum, *Pyrus communis*, *P. Cydonia*, *P. malus*,
P. nivalis, *P. salicifolia*, *Quercus Ægilops*, *Q. Cerris*,
Q. coccifera, *Q. Ilex*, *Q. infectoria*, *Q. Robur*, *Q. Su-*
ber, *Q. Toza*, *Reseda luteola*, *R. odorata*, *Rhamnus*
amygdalinus, *R. catharticus*, *R. Græcus*, *R. infecto-*
rius, *R. oleoides*, *R. prunifolius*, *R. saxatilis*, *Rhap-*
onticum acaule, *Rheum Rhaponticum*, *Rhus Coriaria*,
R. Cotinus, *Ribes Grossularia*, *R. nigrum*, *R. rubrum*,
Ricinus communis, *Rosa centifolia*, *R. Damascena*,
R. Gallica, *R. moschata*, *R. sempervirens*, *Rosmari-*
nus officinalis, *Rubia peregrina*, *R. tinctorum*, *Rubus*
fruticosus, *R. Idæus*, *Rumex Acetosa*, *R. scutatus*,
Ruscus aculeatus, *Ruta graveolens*, *R. silvestris*, *Sag-*
ittaria sagittifolia, *Salix alba*, *S. Babylonica*, *S. daph-*
noides, *S. purpurea*, *S. rubra*, *S. viminalis*, *Salvia of-*
ficialis, *Sambucus nigra*, *Santolina cyparissias*, *Sa-*
ponaria officinalis, *Satureja Græca*, *S. hortensis*, *S.*
Juliana, *S. montana*, *S. Thymbra*, *Saussurea Lappa*,
Scandix grandiflora, *Scorzonera Astrachanica*, *S. cro-*
cifolia, *S. deliciosa*, *S. Hispanica*, *S. lanata*, *S. ramo-*
sa, *S. Scowitzii*, *S. semicana*, *S. tuberosa*, *S. undulata*,
Secale cereale, *Sison amomum*, *Smilax aspera*, *Smyr-*
niun Olusatrum, *Solanum Æthiopicum*, *S. Dulcamara*,
S. edule, *S. xanthocarpum*, *Spartium junceum*, *Spin-*
acia tetrandra, *Stenotaphrum Americanum*, *Stipa are-*
naria, *S. tenacissima*, *Styrax officinalis*, *Symphytum*

asperrimum, *S. officinale*, *Tamarindus Indica*, *Tamarix articulata*, *T. Gallica*, *T. Germanica*, *Tanacetum vulgare*, *Taraxacum officinale*, *Taxusbaccata*, *Terfezia Leonis*, *Teucrium Chamædrys*, *T. Creticum*, *T. Marum*, *T. Polium*, *T. Scordium*, *Thapsia edulis*, *Theligonum cynocrambe*, *Thouarea sarmentosa*, *Thymelæa tinctoria*, *Thymus æstivus*, *T. capitatus*, *T. hiemalis*, *T. Mastichina*, *T. Serpillum*, *T. vulgare*, *Tilia argentea*, *T. Europæa*, *Tinguarra Sicula*, *Tragopogon porrifolius*, *Trappa natans*, *Trifolium agrarium*, *T. Alexandrinum*, *T. fragiferum*, *T. hybridum*, *T. incarnatum*, *T. medium*, *T. pratense*, *T. Quartinianum*, *T. repens*, *T. subrotundum*, *Trigonella Fœnum-Græcum*, *Triticum junceum*, *T. vulgare*, *Tuber æstivum*, *T. albidum*, *T. cibarium*, *T. magnatum*, *Ulmus campestris*, *U. pedunculata*, *Urginia Scilla*, *Vaccinium Myrtillus*, *V. Oxycoccus*, *V. uliginosum*, *V. Vitis - Idæa*, *Valeriana officinalis*, *Valerianella olitoria*, *Veratrum album*, *Vicia Ervilia*, *V. Faba*, *V. sativa*, *Viola odorata*, *Vitis Schimperiana*, *V. vinifera*, *Zelkova crenata*, *Z. Cretica*, *Zizyphus Lotus*, *Z. Spina-Christi*, *Z. vulgare*.

MIDDLE AND TEMPERATE EASTERN ASIA.

Acer palmatum, *A. pictum*, *Ailanthus glandulosa*, *Albizia Julibrissin*, *Allium fistulosum*, *Aralia cordata*, *Arenga saccharifera* (under *Zalacca*), *Aristolochia recurvilabra*, *Artemisia Cina*, *A. Dracunculus*, *Arun-
dinaria Japonica* (under *Schizostachyum*), *Atriplex hortensis*, *Avena elatior*, *A. fatua*, *A. flavescens*, *A. pubescens*, *Balsamodendron Mukul*, *Bambusa Beech-
ana*, *B. flexuosa*, *B. tultoides* (under *Schizostachyum*),

Basella rubra, *Betula alba*, *Bœhmeria nivea*, *Brassica alba*, *B. Chinensis*, *B. juncea*, *B. nigra*, *Broussonetia papyrifera*, *Buxus microphylla*, *Cæsalpinia sepiaria*, *Cannabis sativa*, *Caragana arborescens*, *Carpinus cordata*, *C. erosa*, *C. Japonica*, *C. laxiflora*, *Carum Bulbocastanum*, *C. Carui*, *Cephalotaxus Fortunei*, *Chamærops excelsa*, *C. Fortunei*, *Cinnamomum Camphora*, *Citrus Japonica*, *Corechorus capsularis*, *Cordyline Ti*, *Corylus heterophylla*, *Cryptomeria Japonica*, *Cucumis Conomon*, *Cupressus obtusa*, *C. pisifera*, *Cycas revoluta*, *Daucus Carota*, *Debregeasia edulis*, *Dendrocalamus strictus* (under *Schizostachyum*), *Dioscorea Japonica*, *D. oppositifolia*, *D. quinqueloba*, *D. sativa*, *Diospyros Kaki*, *D. Lotus*, *Ehrharta caudata*, *Elæagnus parvifolius*, *Eleusine Coracana*, *Excæcaria sebifera*, *Euryale ferox*, *Eurangium Sumbul*, *Fagopyrum cymosum*, *F. emarginatum*, *F. esculentum*, *F. Tataricum*, *Fagus Sieboldii*, *Flueggea Japonica*, *Fraxinus Chinensis*, *Ginkgo biloba*, *Gleditschia horrida*, *Glycine hispida*, *G. Soya*, *Heleocharis tuberosa*, *Hovenia dulcis*, *Illicium anisatum*, *Isatis indigotica*, *I. tinctoria*, *Jasminum grandiflorum*, *J. officinale*, *J. Sambac*, *Juglans cordiformis*, *J. Mandschurica*, *J. Sieboldiana*, *J. stenocarpa*, *Juniperus Chinensis*, *J. spherica*, *Lespedeza striata*, *Ligustrum Japonicum*, *Livistona Chinensis*, *Magnolia Yulan*, *Morus alba*, *Musa Cavendishii*, *Myrtus tomentosa*, *Nageia cupressina*, *Nephelium Litchi*, *N. Longanum*, *Pachyma Helen*, *Paliurus ramosissimus*, *Panax papyrifera*, *Pennisetum cereale*, *Perilla arguta*, *Phoenix pulchra*, *Phyllostachys bambusoides*, *P. nigra* (under *Schizostachyum*), *Physalis Alkekengi*, *P. angulata*, *Pinus Alcockiana*, *P. Fortunei*, *P. Kämpferi*, *P. Koraiensis*, *P. leptolepis*,

P. Massoniana, *P. parviflora*, *P. Sibirica*, *P. Tsuga*, *Planera Japonica*, *Polygaster Sampadarius*, *Polygonum tinctorium*, *Populus nigra*, *P. tremula*, *Prangos pabularia*, *Pterocarpus Indicus*, *Pterocarya fraxinifolia*, *P. stenoptera*, *Pyrus Japonica*, *Quercus cornea*, *Q. glabra*, *Q. Mongolica*, *Q. serrata*, *Rhamnus chlorophorus*, *R. utilis*, *Rhapis flabelliformis*, *R. humilis*, *Rheum officinale*, *R. palmatum*, *R. Rhaponticum*, *R. Tataricum*, *R. undulatum*, *Rhus semialata*, *R. succedanea*, *R. vernicifera*, *Rosa Indica*, *R. lævigata*, *R. moschata*, *R. sempervirens*, *Rubia cordifolia*, *Rumex Acetosa*, *Saccharum officinarum*, *S. Sinense*, *Sagittaria sagittifolia*, *Salix Babylonica*, *Sciadopitys verticillata*, *Scorzonera albicaulis*, *Selinum Monnieri*, *Sophora Japonica*, *Spinacia oleracea*, *Tetragonia expansa*, *Tetranthera Japonica*, *Thea Chinensis*, *Tilia Europæa*, *T. Manchurica*, *Thuyopsis dolabrata*, *Torreya grandis*, *T. nucifera*, *Trapa bicornis*, *T. bispinosa*, *Trifolium pratense*, *Triphasia Aurantiola*, *Ulmus campestris*, *U. parvifolia*, *Vaccinium præstans*, *Veratrum album*, *Vigna Sinensis*, *Vitis Labrusca*, *V. vulpina*, *Zizania latifolia*, *Zizyphus Jujuba*, *Z. Sinensis*.

SOUTHERN ASIA.

Acacia Arabica, *A. Catechu*, *A. concinna*, *A. Farnesiana*, *A. latronum*, *A. Sundra*, *Acer lævigatum*, *Acer sterculiaceum*, *A. villosum*, *Aconitum ferox*, *Ægiceras majus*, *Æschynomene aspera*, *Albizzia Lebbeck*, *Aloe Socotrina*, *Aloexylon Agallochum*, *Andropogon Calamus*, *A. cernuus*, *A. citratus*, *A. Ivarancusa*, *A. Martini*, *A. muricatus*, *A. Nardus*, *A.*

pertusus, *A. saccharatus*, *A. Schoenanthus*, *A. Sorghum*, *Anthistiria ciliata*, *Aponogeton crispus*, *Aquilaria Agallocha*, *Areca Nagensis*, *A. triandra* (under *Zalacca*), *Aristolochia Indica*, *Arundinaria falcata*, *A. callosa*, *A. debilis*, *A. Hookeriana*, *A. Khasiana*, *A. suberecta* (under *Schizostachyum*), *Averrhoa Bilimbi*, *A. Carambola*, *Avicennia officinalis*, *Azima tetracantha*, *Bambusa arundinacea*, *B. attenuata*, *B. elegantissima*, *B. monadelphica*, *B. spinosa*, *B. stricta*, *B. verticillata*, *B. vulgaris*, *Bambusa Balcooa*, *B. Blumeana*, *B. Brandisii*, *B. marginata*, *B. nutans*, *B. pallida*, *B. polymorpha*, *B. regia*, *B. Tulda* (under *Schizostachyum*), *Basella lucida*, *B. rubra*, *Beesha Rheedei*, *B. stridula*, *B. Travancorica* (under *Schizostachyum*), *Benincasa cerifera*, *Bentinckia Coddapanna* (under *Zalacca*), *Berberis aristata*, *B. Asiatica*, *B. lycium*, *Bœhmeria nivea*, *Borassus flabelliformis*, *Brassica juncea*, *Butea frondosa*, *Buxus Wallichiana*, *Cæsalpinia Sappan*, *C. sepiaria*, *Cajanus Indicus*, *Calamus montanus*, *Calamus acanthospathus*, *C. erectus*, *C. extensus*, *C. Flagellum*, *C. floribundus*, *C. leptospathus*, *C. macrospathus*, *C. Mishmelensis*, *C. quinquenervius*, *C. Royleanus*, *C. schizospathus*, *C. tenuis* (under *Zalacca*), *Capparis aphylla*, *C. horrida*, *C. Roxburghi*, *C. sepiaria*, *Carex Mooreroftiana*, *Carissa Carandas*, *Carpinus viminea*, *Carthamus tinctorius*, *Carum Ajowan*, *C. gracile*, *C. nigrum*, *Caryota obtusa* (under *Zalacca*), *Caryota urens*, *Cassia fistula*, *Castaneopsis argentea*, *Cephalostachyum capitatum*, *C. pallidum*, *C. pergracile* (under *Schizostachyum*), *Chamaerops Martiana*, *C. Richieana*, *Chloroxylon Swietenia*, *Chrysanthemum roseum*, *Citrus Aurantium*, *C. medica*, *Colocasia antiquorum*, *C. Indica*, *Corchorus cap-*

sularis, *C. olitorius*, *Crambe cordifolia*, *Crotalaria juncea*, *C. retusa*, *Cucumis cicatrisatus*, *C. Colocynthis*, *C. Momordica*, *C. utilissimus*, *Cupressus torulosa*, *Cynodon Dactylon*, *Cyperus corymbosus*, *Dæmonorops Guruba*, *D. Jenkinsii*, *D. nutantiflorus* (under *Zalacca*), *Dammara alba*, *Debregeasia dichotoma*, *D. hypoleuca*, *D. velutina*, *D. Wallichiana*, *Dendrocalamus flagellifer*, *D. giganteus*, *D. Hamiltonii*, *D. Hookerii*, *D. sericeus*, *D. strictus* (under *Schizostachyum*), *Desmodium triflorum*, *Dioscorea aculeata*, *D. alata*, *D. deltoides*, *D. globosa*, *D. nummularia*, *D. oppositifolia*, *D. pentaphylla*, *D. purpurea*, *D. sativa*, *D. spicata*, *D. tomentosa*, *D. tryphilla*, *Diospyros chloroxylon*, *D. Ebenum*, *D. Melanoxylon*, *D. oppositifolia*, *D. quæsitata*, *Dolichos uniflorus*, *Eleusine Corocana*, *E. stricta*, *Engelhardtia spicata*, *Eugenia cordifolia*, *E. Jambos*, *E. maboides*, *E. malaccensis*, *E. revoluta*, *E. rotundifolia*, *Euryale ferox*, *Fagopyrum cymosum*, *F. emarginatum*, *F. rotundatum*, *F. triangulare*, *Ficus elastica*, *F. laccifera*, *Flacourtia cataphracta*, *F. Ramontchi*, *Flemingia tuberosa*, *Fraxinus floribunda*, *Gigantochloa atter*, *G. heterostachya*, *G. maxima* (under *Schizostachyum*), *Glycine hispida*, *Gossypium arboreum*, *G. herbaceum*, *Guizotia oleifera*, *Gunnera macrophylla*, *Heleocharis fistulosa*, *H. plantaginea*, *Hibiscus cannabinus*, *Holoptelea integrifolia*, *Indigofera argentea*, *I. tinctoria*, *Ipomœa mammosa*, *I. paniculata*, *Jasminum grandiflorum*, *J. Sambac*, *Juniperus recurva*, *Justicia Adhatoda*, *Lactuca sativa*, *Lawsonia alba*, *Licuala peltata* (under *Zalacca*), *Liquidambar Altingia*, *Livistona Jenkinsii* (under *Zalacca*), *Magnolia Campbellii*, *M. sphærocarpa*, *Maharanga Emodi*, *Mallotus Philippinensis*, *Maoutia Puya*, *Melaleuca Leucadendron*,

Melia Azedarach, *Melocanna bambusoides*, *M. humilis*, *Mimosa rubicaulis*, *Moringa pterygosperma*, *Morus atropurpurea*, *Musa coccinea*, *M. paradisiaca*, *M. sapientum*, *M. simiarum*, *M. troglodytarum*, *Myrica sapida*, *Myrtus tomentosa*, *Nageia amara*, *N. cupressina*, *Nardostachys grandiflora*, *N. Jatamansi*, *Nastus Borbonicus* (under *Schizostachyum*), *Nepheium lappaceum*, *N. Longanum*, *Ocimum Basilicum*, *O. canum*, *O. gratissimum*, *O. sanctum*, *Ophelia Chirata*, *O. elegans*, *Oryza sativa*, *Oxytenanthera albociliata*, *O. nigro-ciliata*, *O. Thwaitesii* (under *Schizostachyum*), *Pandanus furcatus*, *Panicum brizanthum*, *P. frumentaceum*, *P. Italicum*, *P. Koenigii*, *P. miliaceum*, *P. prostratum*, *P. repens*, *P. sarmentosum*, *P. virgatum*, *Paspalum distichum*, *P. scrobiculatum*, *Pennisetum thyphoideum*, *Perilla ocimoides*, *Peucedanum Sowa*, *Phaseolus adenanthus*, *P. lunatus*, *P. Mungo*, *P. vulgaris*, *Phoenix humilis*, *P. Ouseloyana* (under *Zalacca*), *Phoenix paludosa*, *P. pulsilla*, *P. Silvestris*, *Phyllostachys bambusoides* (under *Schizostachyum*), *Pinus Cedrus*, *P. dumosa*, *P. excelsa*, *P. Gerardiana*, *longifolia*, *P. Pindrow*, *P. Webbia*, *Pipturus propinquus*, *P. velutinus*, *Plectocomia Assamica* (under *Zalacca*), *Plectocomia Himalayana*, *Plectocomia Khasyana* (under *Zalacca*), *Poa cynosuroides*, *Podophyllum Emodi*, *Pogostemon Heyneanus*, *P. parviflorus*, *P. Patchouli*, *Polygala crotalaroides*, *Polygaster Sampadarius*, *Prosopis spicifera*, *Pseudostachyum polymorphum* (under *Schizostachyum*), *Pterocarpus Indicus*, *P. Marsupium*, *P. santalinus*, *Ptychosperma gracilis* (under *Zalacca*), *Pyrularia edulis*, *Quercus annulata*, *Q. incana*, *Q. lancifolia*, *Q. semecarpifolia*, *Q. squamata*, *Q. Sundaica*, *Raphanus cau-*

datum, *R. sativum*, *Rheum Australe*, *R. officinale*,
Rhododendron Falconeri, *Rhus vernicifera*, *Ribes*
glaciale, *R. Griffithii*, *R. laciniatum*, *R. villosum*,
Ricinus communis, *Rosa Indica*, *R. moschata*, *R.*
sempervirens, *Rubia cordifolia*, *Rubus rugosus*, *Sac-*
charum officinarum, *S. spontaneum*, *S. violaceum*,
Santalum album, *Schizostachyum Blumei*, *Scutia*
Indica, *Sesamum Indicum*, *Sesbania aculeata*, *S.*
cannabina, *Solanum album*, *S. ferox*, *S. insanum*, *S.*
longum, *S. Melongena*, *S. pseudo-saponaceum*, *S.*
undulatum, *S. xanthocarpum*, *Spinifex squarrosus*,
Stenotaphrum Americanum, *Streblus asper*, *Tama-*
rindus Indica, *Tamarix articulata*, *T. Gallica*, *Tecto-*
nia grandis, *Teinostachyum attenuatum*, *T. Griffithii*
 (under *Schizostachyum*), *Terminalia Catappa*, *T. par-*
viflora, *Tetranthera calophylla*, *T. laurifolia*, *Thamno-*
calamus Falconeri, *T. spathiflorus* (under *Schizosta-*
chyum), *Thea Chinensis*, *Thouarea sarmentosa*, *Trapa*
bispinosa, *T. Cochinchinensis*, *T. incisa*, *T. quadrispi-*
nosa, *Triphasia Aurantiola*, *Vaccinium Leschenaulti*,
Vigna Sinensis, *Villebrunea frutescens*, *V. integri-*
folia, *Vitis auriculata*, *V. Blumeana*, *V. elongata*, *V.*
imperialis, *V. Indica*, *V. Labrusca*, *V. lævigata*, *V.*
mutabilis, *V. quadrangularis*, *V. thyrsoiflora*, *V. vul-*
pina, *Wallichia caryotoides*, *W. oblongifolia*, *W. ob-*
tusifolia, *Ximenia Americana*, *Zalacca secunda*, *Zin-*
giber officinale, *Zizyphus Jujuba*, *Z. rugosa*.

WESTERN SOUTH AMERICA.

Acacia Cavenia, *Adenostemum nitidum*, *Adesmia*
balsamica, *Alstroemeria pallida*, *Andropogon argente-*
us, *Anona Cherimolia*, *Apium proscratum*, *Arachis*

hypogæa, Araucaria imbricata, Aristotelia Macqui, Arracacha xanthorrhiza, Berberis buxifolia, B. Darwinii, Cæsalpinia brevifolia, C. tinctoria, Canna edulis, Ceroxylon andicola, Cereus Quiseo, Ceroxylon Australe, C. pithyrophyllum (under Wettinia), Cervantesia tomentosa, Chenopodium Quinoa, Chusquea Culeon, C. Dombeyana, C. montana, C. Quila, C. tenuiflora (under Schizostachyum), Cinchona Calisaya, C. micrantha, C. nitida, C. officinalis, C. succirubra, Dactylis cæspitosa, Dioscorea Piperifolia, Diplothemium Porallys (under Wettinia), Diposis Bulbocastanum, Drimys Winteri, Elymus condensatus, Embothrium coccineum, E. emarginatum, E. lanceolatum, Erythroxyton Coca, Eucryphia cordifolia, Eugenia Hallii, Euterpe andicola, E. Hænkena, E. longivaginata (under Wettinia), Fagus Dombeyi, F. obliqua, F. procera, Festuca coiron, Fitzroya Patagonica, Fragaria Chiloensis, Geonoma densa (under Wettinia), Gossypium religiosum, Guadua angustifolia, G. latifolia, Guevina Avellana, Gunnera Chilensis, Helianthus annuus, H. tuberosus, Heliotropium Peruvianum, Hibiscus esculentus, Hypochoeris apargioides, H. Scorzoneræ, Ipomœa Batatas, Jubæa spectabilis, Lapageria rosea, Lardizabala biternata, Laurelia aromatica, L. serrata, Libocedrus Chilensis, L. tetragona, Lippia citriodora, Manihot Aipi, Maranta arundinacea, Maytenus Boaria, Melicocca bijuga, Morus celtidifolia, M. insignis, Myrtus Luma, M. Meli, M. nummularia, M. Ugni, Nageia andina, N. Chilina, N. nubigena, Opuntia vulgaris, Oreodoxa frigida (under Wettinia), Oryza latifolia, Oxalis crassicaulis, O. crenata, O. enneaphylla, O. succulenta, O. tuberosa, Pacchyrrhizus angulatus, Panicum pilosum, Passiflora alata, P. ligularis,

Persea gratissima, *Peumus Boldus*, *Physalis Peruviana*, *Phytelephas æquatorialis* (under *Wettinia*), *Prosopis horrida*, *P. juliflora*, *P. Siliquastrum*, *Priva lævis*, *Quillaja saponaria*, *Rhus caustica*, *Rubus geoides*, *Salix Humboldtiana*, *Saxono-Gothæa conspicua*, *Smilax officinalis*, *Solanum Gilo*, *S. Lycopersicum*, *S. muricatum*, *S. Quitoense*, *S. tuberosum*, *S. torvum*, *Sophora tetraptera*, *Spilanthus oleracea*, *Tagetes glanduligera*, *Tetragonia expansa*, *Tropæolum majus*, *T. minus*, *T. sessilifolium*, *T. tuberosum*, *Ullucus tuberosus*, *Vaccinium alatum*, *V. bicolor*, *V. grandiflorum*, *V. melliflorum*, *Wettinia augusta*, *W. Maynensis*, *Witheringia solanacea*, *Zea Mays*, *Zizyphus Ioazeiro*.

WESTERN NORTH AMERICA.

Acer macrophyllum, *Arbutus Menziesii*, *Baccharis consanguinea*, *B. pilularis*, *Castaneopsis chrysophylla*, *Ceanothus prostratus*, *C. rigidus*, *C. thyrsiflorus*, *Cercocarpus ledifolius*, *C. Parvifolius*, *Chlorogalum pomeridianum*, *Cupressus Lawsoniana*, *C. macrocarpa*, *C. Nutkaensis*, *Cymopterus glomeratus*, *Fraxinus Oregona*, *Juglans rupestris*, *Juniperus occidentalis*, *Libocedrus decurrens*, *Myrrhis occidentalis*, *Nicotiana multivalvis*, *Parkinsonia aculeata*, *P. microphylla*, *Pinus amabilis*, *P. contorta*, *P. Coulteri*, *P. Douglasii*, *P. grandis*, *P. Jeffreyi*, *P. Lambertiana*, *P. Menziesii*, *P. Mertensiana*, *P. monophylla*, *P. monticola*, *P. muricata*, *P. nobilis*, *P. Pattoniana*, *P. ponderosa*, *P. radiata*, *P. Sabiniana*, *Platanus racemosa*, *Populus tremuloides*, *P. trichocarpa*, *Prosopis pubescens*, *Prunus ilicifolia*, *Quercus densiflora*, *Q. Douglasi*, *Q. lo-*

bata, *Ribes aureum*, *R. divaricatum*, *R. niveum*, *R. tenuiflorum*, *R. viliosum*, *Rubus macropetalus*, *Scilla esculenta*, *Sequoia sempervirens*, *S. Wellingtonia*, *Solanum Fendleri*, *S. tuberosum*, *Tetranthera Californica*, *Torreya Californica*, *Vaccinium humifusum*, *Valeriana edulis*.

EASTERN NORTH AMERICA.

Acer dasycarpum, *A. Negundo*, *A. rubrum*, *A. saccharinum*, *Achillea Millefolium*, *Achras Sapota*, *Acorus Calamus*, *Actæa alba*, *Agave Americana*, *A. Mexicana*, *Agrostis alba*, *A. rubra*, *Aletris farinosa*, *Allium Schoenoprasum*, *Amelanchier Botryapium*, *Andropogon nutans*, *Apios tuberosa*, *Apocynum cannabinum*, *Aretostaphylos uva-ursi*, *Aristolochia anguicida*, *A. ovalifolia*, *A. Serpentaria*, *Arundinaria macrosperma*, *Betula lenta*, *B. lutea*, *B. nigra*, *B. papyracea*, *Buchloa dactyloides*, *Calamagrostis longifolia*, *Canna flaccida*, *Carya alba*, *C. amara*, *C. glabra*, *C. oliviformis*, *C. sulcata*, *C. tomentosa*, *Cassia Marylandica*, *Catalpa bignonioides*, *Cedronella cordata*, *Celtis occidentalis*, *Chamædora concolor*, *Chamærops Hystrix*, *Cimicifuga racemosa*, *Cinna arundinacea*, *Cochlearia officinalis*, *Cratægus æstivalis*, *C. apiifolia*, *C. coccinea*, *C. cordata*, *C. Crus-Galli*, *C. parvifolia*, *C. tomentosa*, *Cupressus Benthami*, *C. Lindleyi*, *C. thurifera*, *C. thuyoides*, *Diospyros Virginiana*, *Elymus mollis*, *Festuca flava*, *F. purpurea*, *Fragaria Chilcensis*, *F. grandiflora*, *F. Illinoensis*, *F. vesca*, *F. Virginiana*, *Fraxinus Americana*, *F. platycarpa*, *F. pubescens*, *F. quadrangulata*, *F. sambueifolia*, *F. viridis*, *Gaultieria Shallon*, *Gaylussacia frondosa*, *G. resinosa*, *Gelseminum nitidum*, *Gle-*

ditschia monosperma, *G. triacanthos*, *Guilandia Bon-
 due*, *Gymnocladus Canadensis*, *Hedeoma pulegioides*,
Hordeum secalinum, *Humulus Lupulus*, *Hydrastis
 Canadensis*, *Ilex Cassine*, *Indigofera Anil*, *Ipomœa
 platanifolia*, *I. simulans*, *Juglans cinerea*, *J. nigra*,
Juniperus flaccida, *J. Mexicana*, *J. Virginiana*, *Lev-
 isia rediviva*, *Liatris odoratissima*, *Lindera Benzo-
 in*, *Liquidambar styraciflua*, *Liriodendron tulipifera*,
Lithospermum canescens, *L. hirtum*, *L. longiflorum*,
Lupinus perennis, *Lycopodium lucidulum*, *Maclura
 aurantiaca*, *Magnolia acuminata*, *M. cordata*, *M. Fra-
 seri*, *M. grandiflora*, *M. macrophylla*, *M. umbrella*,
Melica mutica, *Menyanthes trifoliata*, *Milium effu-
 sum*, *Monarda diuyma*, *M. fistulosa*, *M. punctata*,
Morchella esculenta, *Morus rubra*, *Myrica cerifera*,
Nelumbo lutea, *Nicotiana quadrivalvis*, *N. repanda*,
N. rustica, *N. tabacum*, *Nyssa multiflora*, *N. uniflora*,
Opuntia coccinellifera, *O. Ficus - Indica*, *O. Hernan-
 dezii*, *O. Missouriensis*, *O. Rafinesquii*, *O. spinosissi-
 ma*, *O. tuna*, *O. vulgaris*, *Oryza latifolia*, *O. perennis*,
Ostrya Virginica, *Oxalis Deppei*, *O. esculenta*, *O.
 tetraphylla*, *O. violacea*, *Panicum amarum*, *P. virga-
 tum*, *Parkinsonia aculeata*, *Passiflora incarnata*, *P.
 lutea*, *P. suberosa*, *Peireskia aculeata*, *P. Bleo*, *P.
 portulacifolia*, *Phaseolus perennis*, *Physalis angulata*,
Pinus alba, *P. Australis*, *P. Ayacahuite*, *P. balsamea*,
P. Canadensis, *P. cembroides*, *P. Fraseri*, *P. Hart-
 wegii*, *P. Hudsonica*, *P. leiophylla*, *P. mitis*, *P.
 Montezumæ*, *P. nigra*, *P. patula*, *P. pendula*, *P.
 Pinceana*, *Pseudo - strobilus*, *P. religiosa*, *P. rigida*,
P. rubra, *P. serotina*, *P. strobilus*, *P. Tæda*, *P. tenu-
 folia*, *P. Teocote*, *Pisonia aculeata*, *Planera aquat-
 ica*, *Platanus occidentalis*, *Poa angustifolia*, *P. aquat-*

ica, *P. Canadensis*, *P. distans*, *P. fluitans*, *P. maritima*, *P. nemoralis*, *Podophyllum peltatum*, *Polygala Senega*, *Populus balsamifera*, *P. grandidentata*, *P. heterophylla*, *P. monilifera*, *P. tremuloides*, *Prosopis dulcis*, *P. glandulosa*, *P. juliflora*, *P. pubescens*, *Prunus Americana*, *P. chisasa*, *P. maritima*, *P. Pennsylvanica*, *P. pumila*, *P. serotina*, *P. Virginiana*, *Psamma arenaria*, *Pycnanthemum incanum*, *P. montanum*, *Pyralaria edulis*, *Pyrus coronaria*, *Quercus acutifolia*, *Q. alba*, *Q. aquatica*, *Q. chrysophylla*, *Q. coccinea*, *Q. falcata*, *Q. glaucescens*, *Q. lanceolata*, *Q. laurina*, *Q. lyrata*, *Q. macrocarpa*, *Q. obtusata*, *Q. obtusiloba*, *Q. palustris*, *Q. Phellos*, *Q. Prinus*, *Q. reticulata*, *Q. rubra*, *Q. Sideroxyton*, *Q. virens*, *Q. Xalapensis*, *Rhus copallina*, *R. glabra*, *R. typhina*, *Ribes aureum*, *R. Floridum*, *R. hirtellum*, *R. Hudsonianum*, *R. nigrum*, *R. rotundifolium*, *R. rubrum*, *Robina Pseudo-acacia*, *Rosa setigera*, *Rubus Arcticus*, *R. Canadensis*, *R. Chamæmorus*, *R. cuneifolius*, *R. deliciosus*, *R. occidentalis*, *R. odoratus*, *R. strigosus*, *R. trivialis*, *R. villosus*, *Rumex Acetosa*, *Sabal Adansoni*, *S. Palmetto*, *S. serrulata*, *Sagittaria lancifolia*, *S. obtusa*, *Salix cordata*, *S. longifolia*, *S. lucida*, *S. nigra*, *S. petiolaris*, *S. tristis*, *Sassafras officinale*, *Schoenocaulon officinale*, *Shepherdia argentea*, *Smilax medica*, *S. rotundifolia*, *Solanum calycinum*, *S. Fendleri*, *S. tuberosum*, *Spartina cynosuroides*, *S. juncea*, *S. polystachya*, *Spigelia Marylandica*, *Stenotaphrum Americanum*, *Tanacetum vulgare*, *Taraxacum officinale*, *Taxodium distichum*, *T. macronatum*, *Taxus brevifolia*, *Thuja gigantea*, *T. occidentalis*, *Tilia Americana*, *Tilia heterophylla*, *Torreya taxifolia*, *Trifolium repens*, *Tripsacum dactyloides*, *Ulmus alata*, *U. Americana*, *U. crassifolia*, *U.*

fulva, *U. Mexicana*, *U. racemosa*, *Uvularia sessilifolia*, *Vaccinium cæspitosum*, *V. corymbosum*, *V. erythrocarpum*, *V. leucanthum*, *V. macrocarpum*, *V. myrtilloides*, *V. Myrtilus*, *V. ovalifolium*, *V. Oxycoccus*, *V. parvifolium*, *V. Pennsylvanicum*, *V. uliginosum*, *V. vaccillans*, *V. Vitis-Idæa*, *Valeriana edulis*, *Veratrum viride*, *Vitis æstivalis*, *V. Labrusca*, *V. vulpina*, *Xanthorrhiza apiifolia*, *Ximenia Americana*, *Yucca æoifolia*, *Y. filamentosa*, *Y. gloriosa*, *Zizania aquatica*, *Z. miliacea*.

CENTRAL AMERICA.

Achras Spota, *Agave Americana*, *Anona muricata*, *A. squamosa*, *Arracacha xanthorrhiza*, *Arthrostyidium excelsum*, *A. longiflorum*, *A. racemiferum* (under *Schizostachyum*), *Arundinaria acuminata*, *Aulonemia Quexo* (under *Schizostachyum*), *Bactris Gasipaes*, *Brahea dulcis*, *Buxus acuminata*, *B. citrifolia*, *B. Cubana*, *B. glomerata*, *B. gonoclada*, *B. laevigata*, *B. Purdieana*, *B. retusa*, *B. subcolumellaris*, *B. VahlII*, *B. Wrightii*, *Canna coccinea*, *C. glauca*, *Carludovica palmata* (under *Wettinia*), *Ceroxylon andicola*, *C. Klopstockia* (under *Wettinia*), *Chusquea abietifolia*, *C. Fendleri*, *C. Galeottiana*, *C. scandens*, *C. simpliciflora*, *C. uniflora* (under *Schizostachyum*), *Copernicia nana*, *C. Pumos*, *Cyperus giganteus*, *Dioscorea Cayennensis*, *D. esurientum*, *D. trifida*, *Eupatorium tripplinerve*, *Fourcroya Cubensis*, *F. gigantea*, *F. longæva*, *Geonema undata*, *Gossypium Barbadosense*, *G. hirsutum*, *G. religiosum*, *Hibiscus esculentus*, *Indigofera Anil*, *Ipomœa Batatilla*, *Juniperus Bermudiana*, *Kunthia montana*, *Maranta arundinacea*, *Melicocca bijuga*,

Morus celtidifolia, *Nageia Purdieana*, *Opuntia coccinellifera*, *O. Dillenii*, *O. elatior*, *O. Hernandezii*, *O. spinosissima*, *O. tuna*, *Pacchyrrhizus angulatus*, *Passiflora laurifolia*, *P. ligularis*, *P. maliformis*, *P. serrata*, *Peireskia aculeata*, *Persea gratissima*, *Platenia Chiragua* (under *Wettinia*), *Pithecolobium dulce*, *Psidium acidum*, *P. Araca*, *P. cordatum*, *P. Guayava*, *P. polycarpum*, *Sechium edule*, *Smilax officinalis*, *S. papyracea*, *Solanum Plumieri*, *S. Topiro*, *S. torvum*, *Swietenia Mahagoni*, *Thrinax argentea*, *T. parviflora*, *Trophis Americana*, *Vaccinium meridionale*, *V. Moritina*, *Zizania miliacea*.

EASTERN SOUTH AMERICA.

Acrocomia Totai (under *Wettinia*), *Amyris terebinthifolia*, *Apium prostratum*, *Araucaria Braziliensis*, *Arundinaria verticillata* (under *Schizostachyum*), *Arundo saccharoides*, *A. Sellowiana*, *Bromus unioloides*, *Caesalpinia coriaria*, *C. Gilliesii*, *Calyptranthes aromatica*, *Canna Achiras*, *Capsicum annuum*, *C. baccatum*, *C. frutescens*, *C. longum*, *Cephaelis Ipecacuanha*, *Chenopodium ambrosioides*, *Chusquea capituliflora*, *C. Gaudichaudiana* (under *Schizostachyum*), *Cocos Australis*, *C. Romanzoffiana*, *C. Zatai* (under *Wettinia*), *Copernicia cerifera*, *Cyperus giganteus*, *Dactylis caespitosa*, *Desmodium triflorum*, *Dioscorea conferta*, *D. tuberosa*, *Diplothemium litorale* (under *Wettinia*), *Eugenia Nhanica*, *E. pyriformis*, *E. supra-axillaris*, *Guadua latifolia*, *Guadua angustifolia*, *G. capitata*, *G. macrostachya*, *G. paniculata*, *G. refracta*, *G. Tagoara*, *G. virgata*, *Hymenæa Courbaril*, *Ilex Paraguensis*, *Indigofera Anil*, *Ipomœa Batatas*, *I. Batatilla*, *I. operculata*, *I. paniculata*, *Iriarteia del-*

toidea, *I. exorrhiza*, *I. ventricosa* (under *Wettinia*),
Lippia citriodora, *Lupinus arboreus*, *Manihot Aipi*,
M. utilissima, *Marliera glomerata*, *M. tomentosa*,
Merostachys Claussenii, *M. Kunthii*, *M. ternata* (un-
 der *Schizostachyum*), *Myrtus edulis*, *Nageia Lam-
 berti*, *Nicotiana rustica*, *N. Tabacum*, *Ocimum gratis-
 simum*, *Enocarpus multicaulis* (under *Wettinia*),
Opuntia vulgaris, *Oryza latifolia*, *Oxalis carnosa*, *O.
 conorrhiza*, *Paechyrrhizus angulatus*, *Panicum barbi-
 node*, *P. latissimum*, *P. pilosum*, *Parkinsonia aculea-
 ta*, *Passiflora alata*, *P. coccinea*, *P. cœrulea*, *P. edulis*,
P. filamentosa, *P. laurifolia*, *P. maliformis*, *P. quad-
 rangularis*, *P. serrata*, *P. suberosa*, *Peireskia aculeata*,
P. Bleo, *P. portulacifolia*, *Periandra dulcis*, *Persea
 gratissima*, *Phaseolus adenanthus*, *P. lunatus*, *Phytel-
 ephas macrocarpa*, *P. microcarpa* (under *Wettinia*),
Prosopis dulcis, *P. Siliquastrum*, *Psidium Araca*, *P.
 arboreum*, *P. Cattleyanum*, *P. chrysophyllum*, *P. cin-
 creum*, *P. euneatum*, *P. grandifolium*, *P. Guayava*,
P. incanescens, *P. lineatifolium*, *P. malifolium*, *P.
 polycarpon*, *P. rufum*, *Salix Humboldtiana*, *Smilax
 papyracea*, *Solanum Gilo*, *S. indigoferum*, *S. Lycop-
 ersicum*, *S. torvum*, *S. tuberosum*, *Spilanthes olera-
 cea*, *Syagrus Saneona*, *Tagetes glanduligera*, *Trithry-
 nax Braziliانا* (under *Wettinia*), *Trophis Americana*,
Ullucus tuberosus, *Zea Mays*, *Zizania microstachya*.

MIDDLE AFRICA (AND MADAGASCAR).

Beesha capitata, *Buddleya Madagascariensis*, *Buxus
 Madagascariensis*, *Hyphæne Thebaica*, *Phœnix spinosa*,
Pterolobium lacerans, *Rubus rosifolius*, *Solanum edule*,
S. Thonningi, *Telfairia occidentalis*, *T. pedata*, *Vigna
 Sinensis*, *Vitis Schimperiana*.

SOUTHERN AFRICA.

Aberia Caffra, *A. tristis*, *A. Zeyheri*, *Acacia Giraffe*, *A. horrida*, *Aloe dichotoma*, *A. ferox*, *A. linguiformis*, *A. plicatilis*, *A. purpurascens*, *A. spicata*, *A. Zeyheri*, *Andropogon Caffrorum*, *Anthistiria ciliata*, *Aponogeton distachyon*, *Arundinaria tessellata*, *Asparagus larinicus*, *Azima tetraantha*, *Barosma serratifolia*, *Cannamois cephalotes*, *Carissa Arduina*, *C. ferox*, *C. grandiflora*, *Carum Capense*, *Combretum butyraceum*, *Elegia nuda*, *Euclea myrtina*, *E. undulata*, *Eugenia Zeyheri*, *Garuleum bipinnatum*, *Gladiolus edulis*, *Gonioma Kamassi*, *Grumilea cymosa*, *Hibiscus Ludwigii*, *Hyphæne ventricosa*, *Leucadendron argenteum*, *Leyssera gnaphalioides*, *Lyperia crocea*, *Matricaria glabrata*, *Melianthus major*, *Mesembryanthemum acinaciforme*, *M. edule*, *Monetia barlerioides*, *Myrica cordifolia*, *M. quercifolia*, *M. serrata*, *Nageia elongata*, *N. Thunbergia*, *Osmitopsis asteriscoides*, *Pappea Capensis*, *Parkinsonia Africana*, *Pentzia virgata*, *Phoenix reclinata*, *Plectronia ciliata*, *P. spinosa*, *P. ventosa*, *Rafnia amplexicaulis*, *R. perfoliata*, *Rhus lucida*, *Royenia Pseudebenus*, *R. pubescens*, *Rubus fruticosus*, *Salix Capensis*, *Selinum anesorrhizum*, *S. montanum*, *Tarchonanthus camphoratus*, *Voandzeia subterranea*, *Widdringtonia juniperoides*.

WESTERN AUSTRALIA.

Acacia acuminata, *A. lophantha*, *A. saligna*, *Boronia megastigma*, *Casuarina Decaisneana*, *C. Fraseriana*, *C. Huegeliana*, *C. trichodon*, *Dioscorea hastifolia*, *Eucephalartos Preissii*, *Eucalyptus calophylla*, *E. cor-*

nuta, *E. diversicolor*, *E. Doratoxylon*, *E. ficifolia*, *E. gomphocephala*, *E. marginata*, *Frenela Actinostrobos*, *Helichrysum lucidum*, *H. Manglesii*, *Lepidosperma gladiatum*, *Oryza sativa*, *Phaseolus vulgaris*, *Pimelea clavata*, *Santalum cygnorum*, *S. Preissianum*, *Spinifex hirsutus*, *S. longifolius*, *Strychnos Nux-Vomica*, *Tamarindus Indica*.

EASTERN AUSTRALIA (INCLUDING TASMANIA).

Acacia decurrens, *A. falcata*, *A. farnesiana*, *A. fasciculifera*, *A. glaucescens*, *A. harpophylla*, *A. homalophylla*, *A. Melanoxylon*, *A. pendula*, *A. pycnantha*, *A. salicina*, *Ægiceras majus*, *Aira cæspitosa*, *Alstonia constricta*, *Andropogon pertusus*, *Angophora intermedia*, *Anthistiria avenacea*, *A. ciliata*, *Apium prostratum*, *Aponogeton crispus*, *Araucaria Bidwilli*, *A. Cunninghamsi*, *Aristolochia Indica*, *Atalantia glauca*, *Atriplex halimoides*, *A. holocarpum*, *A. nummularium*, *Backhousia citriodora*, *Bologhia lucida*, *Brachychiton acerifolium*, *Barissa Brownii*, *Casuarina glauca*, *C. quadrivalvis*, *C. suberosa*, *C. torulosa*, *Cedrela Tana*, *Chenopodium auricomum*, *Citrus Australasica*, *C. Planchoni*, *Colocasia Indica*, *Corechorus Cunninghamsi*, *C. olitorius*, *Crotolaria juncea*, *C. retusa*, *Cudrania Javanensis*, *Cycas angulata*, *C. Normanbyana*, *Cynodon Dactylon*, *Cyperus textilis*, *Dammara robusta*, *Danthonia nervosa*, *D. pectinata*, *D. triticoides*, *Dioscorea sativa*, *D. transversa*, *Ehrharta stipoides*, *Embothrium Wickhami*, *Encephalartos Denisonii*, *E. spiralis*, *Eucalyptus acmenoides*, *E. alpina*, *E. amygdalina*, *E. botryoides*, *E. brachypoda*, *E. citriodora*, *E. coccifera*, *E. coriacea*, *E. crebra*, *E. drepanophyl-*

la, *E. eugenioides*, *E. globulus*, *E. goniocalyx*, *E. Gunnii*, *E. hemiphloia*, *E. leptophleba*, *E. leucoxy-
lon*, *E. maculata*, *E. melanophloia*, *E. melliodora*, *E.
miniata*, *E. obliqua*, *E. paniculata*, *E. Phœnicea*, *E.
pilularis*, *E. platyphylla*, *E. resinifera*, *E. robusta*, *E.
rostrata*, *E. siderophloia*, *E. sideroxylon*, *E. tereticor-
nis*, *E. tessularis*, *E. trachyphloia*, *E. urnigera*, *E.
vernica*, *E. viminalis*, *Eucryphia Billardieri*, *E.
Moorei*, *Eugenia myrtifolia*, *Fagus Cunninghamsii*, *F.
Moorei*, *Festuca distichophylla*, *F. dives*, *F. Hooker-
iana*, *Ficus colossea*, *F. columnaris*, *F. Cunninghamsii*,
F. macrophylla, *F. rubiginosa*, *Flindersia Bennettiana*,
F. Oxleyana, *Frenela Macleayana*, *F. verrucosa*, *Gei-
tonoplesium cymosum*, *Grevillea robusta*, *Harpullia
Hilli*, *Heleocharis spaciolata*, *Helichrysum lucidum*,
Hibiscus cannabinus, *Hierochloa redolens*, *Ipomœa
paniculata*, *Jasminum calcareum*, *J. didymum*, *J.
lineare*, *J. racemosum*, *J. simplicifolium*, *J. suavissi-
mum*, *Kentia Belmoreana*, *K. Canterburyana*, *K.
Mooreana*, *Lepidosperma gladiatum*, *Leptospermum
laevigatum*, *Lycopodium clavatum*, *L. densum*, *L.
laterale*, *L. varium*, *Maba fasciculosa*, *M. geminata*,
Macadamia ternifolia, *Mallotus Philippinensis*, *Marlea
Vitiensis*, *Melia Azedarach*, *Mentha Australis*, *M. gra-
cilis*, *M. laxiflora*, *M. saturejoides*, *Mesembryanthe-
num æquilaterale*, *Microseris Forsteri*, *Mylitta Aus-
tralis*, *Myoporum insulare*, *Myrtus aemenoides*, *Nageia
elata*, *Niemeyera prunifera*, *Ocimum sanctum*, *Oryza
sativa*, *Pandanus Forsteri*, *P. pedunculatus*, *Panicum
decompositum*, *P. Italicum*, *P. miliaceum*, *P. pros-
tratatum*, *P. repens*, *P. sanguinale*, *P. virgatum*, *Pap-
pophorum commune*, *Paspalum distichum*, *Phaseolus
adenanthus*, *P. mungo*, *Phyllocladus rhomboidalis*,

Pimelea stricta, *Pipturus propinquus*, *Pisonia aculeata*, *Pittosporum undulatum*, *Poa Australis*, *P. Brownii*, *Ptychosperma Alexandræ*, *P. Cunninghamsii*, *P. elegans*, *Rubus Gunnianus*, *R. parvifolius*, *R. rosifolius*, *Santalum Preissianum*, *Sebæa albidiflora*, *S. ovata*, *Selaginella uliginosa*, *Sesbania aculeata*, *Smilax Australis*, *S. glycyphylla*, *Solanum vescum*, *Spinifex hirsutus*, *Spondias pleiogyna*, *Stenocarpus sinuosus*, *Synoon glandulosum*, *Tacca pinnatifida*, *Tetragonia expansa*, *T. implexicoma*, *Tetranthera laurifolia*, *Trigonella suavissima*, *Tristania conferta*, *Ulmus parvifolia*, *Vigna lanceolata*, *Vitis acetosa*, *V. Baudiniana*, *V. hypoglauca*, *Ximenia Americana*, *Zizyphus Jujuba*.

NEW ZEALAND.

Apium prostratum, *Cordyline Banksii*, *C. Forsteri*, *C. indivisa*, *Corynocarpus lævigata*, *Daerydium cupressinum*, *Dammara Australis*, *Danthonia Cunninghamsii*, *Ehrharta Diplax*, *E. stipoides*, *Fuchsia excorticata*, *Fagus fusca*, *F. Menziesii*, *F. Solandri*, *Hierochloa redolens*, *Kentia sapida*, *Libocedrus Doniana*, *Metrosideros florida*, *M. lucida*, *M. robusta*, *M. tomentosa*, *Myoporum lætum*, *Nageia dacrydioides*, *N. ferruginea*, *N. spicata*, *N. Totara*, *Phormium tenax*, *Phyllocladus trichomanoides*, *Pittosporum eugenioioides*, *P. tenuifolium*, *Ropogonum scandens*, *Sebæa ovata*, *Tetragonia expansa*, *T. implexicoma*.

POLYNESIA.

Egiceras majus, *Araucaria Cookii*, *A. excelsa*, *Aristolochia Indica*, *Bronssonetia papyrifera*, *Colocasia antiquorum*, *C. Indica*, *Cordyline Baueri*, *Cyrtosperma edulis*, *Dammara macrophylla*, *D. Moorei*, *D. obtusa*, *D. ovata*, *D. Vitiensis*, *Dioscorea aculeata*, *D. alata*, *D. nummularia*, *D. pentaphylla*, *D. sativa*, *Gossypium Taitense*, *G. tomentosum*, *Ipomea paniculata*, *Kentia Baueri*, *Musa Troglodytarum*, *Ocimum gratissimum*, *Pipturus propinquus*, *Pringlea antiscorbutica*, *Saccharum officinarum*, *Santalum Freycinetianum*, *S. Yasi*, *Solanum Uporo*, *Spondias dulcis*, *Stilbocarpa polaris*, *Tacca pinnatifida*, *Tetragonia expansa*.



THE OBJECTS OF A BOTANIC GARDEN IN RELATION TO INDUSTRIES.

A LECTURE,

DELIVERED AT THE INDUSTRIAL AND TECHNOLOGICAL MUSEUM,
MELBOURNE,

BY

Baron Ferd. von Mueller, C.M.G., M.D. Ph.D., F.R.S.

*(Government Botanist for Victoria, and Director of the Botanic Garden of
Melbourne.)*

ON 23d NOVEMBER, 1871.

“Avoid extremes.”

It was originally my intention to limit the lecture, promised for this evening, to an explanation of the bearings of botanic gardens to industrial pursuits; but I found occasion to overstep these precincts, to bring the many other objects of a true botanic garden also, at least briefly, under the view of this audience. The ideas of most people, in reference to the meaning and duties of institutions of this kind, seem so vague

NOTE.—The lecture was illustrated by a large number of growing Plants of industrial value, also by numerous products and educts derived therefrom, as well as by various Museum Plants, Physiognomic Pictures of Vegetation, and other Drawings.

and imperfect that it may be advisable to trace the early origin of such gardens, and to see likewise how far their legitimate functions are generally recognized at the present day ; furthermore, how far, as institutions framed for distinct purposes, they are able to exercise a vivid and powerful influence on education, on technology, on rural pursuits, and on the advancement of independent researches for the enlargement of phytologic knowledge.

The original and ancient appellation of "botanic garden" is hardly any longer applicable in the strict sense of the word, implying a garden for medicinal or otherwise useful herbs, inasmuch as the scope of establishments so named has become vastly extended ; moreover, many of the numerous local gardens passing under this name, particularly in these colonies, have no claims whatever to such a designation.

If much inconvenience was not involved by the lateration of the term, it would be recommendable to recognize the true botanic gardens of this age as scientific gardens ; while all those institutions in which no real phytologic researches are carried out, or in which the main aim does not consist in affording instruction, might well be called public pleasure-gardens, or perhaps recreation-grounds or parks, according to the design for which they are created, or in consonance with the requirements for which they are maintained.

Let us now see how botanic gardens first originated.

The study of plants in Europe arose with the glorious genius of ancient Greece, the earliest historic records in Sanskrit, or the ancient discoveries of the Chinese, being yet wrapped in almost complete ob-

security, particularly as far as plants are concerned.

The Greeks and Romans sought chiefly knowledge of plants which were available for medicine, rural economy, or the work of their artisans ; the number of such plants, in those dawning days of knowledge, while the range of commerce was yet so restricted, being necessarily quite limited. Hippocrates was acquainted with 236 different plants in use at his time (460-351 B. C.). Tyrtamus Eresos, or Theophrastos, as this favorite disciple of Plato and Aristoteles is usually called, records 455 in his writings, some not indigenous to Greece (370-288 B. C.) ; his knowledge being largely imbibed from the teachings of his masters, who must be regarded as the founders of botany as a science, just as many other branches of knowledge owe their origin to these great philosophers. Diogenes Laertius informs us that Theophrastos and his pupil, Demetrius Phalerius, who for ten years was Regent of Athens, possessed a garden, containing as well exotic as indigenous plants, in which he assembled his disciples. This has been considered by some, Cuvier among others, as the first attempt at a botanic garden, and doubtless it was here that Theophrastos instituted many of his numerous observations. Only with the renewed brighter dawning of knowledge in Western Europe his works became there accessible in the fifteenth century, when a Greek refugee, Theodore Gaza, was induced by Pope Nicholas V. to translate into Latin various of the writings of Aristoteles, the *Aphorisms* of Hippocrates, and also Theophrastos' *Natural History of Plants*. Gaza died in Rome in 1478, and the translation appeared first at Trevisa in 1483. The work contains notes on the structure, hab-

its, properties, and modes of propagation of plants, and enumerates, to a certain extent, the species considered utilitarian at that remote time. Many of these results must have been obtained in Theophrastos' garden. Two other disciples of Aristoteles, Phamias Eresios and Dikaarchos of Messene, and a third, whose name remained unknown, have handed over to us by their writings the views entertained by their teacher and themselves on the nature and properties of plants, as recognized in those distant days ; but we have no record of their possessing special scientific gardens.

From the time when the political preponderance of Athens was sinking dates also the decay of learning, once eminent among her citizens. Instead of Athens, for a considerable time Alexandria became the seat of sciences and arts, carried thither principally by Greek emigrants ; and mental culture flourished there under the protection of Ptolemaian Kings of Egypt, amid the horrors and cruelties of that age. Under the wise reign of Ptolemæus Philadelphus (285-247 before Christ) the Museum and Library were founded, the latter then already containing 400,000 rolls. But although Alexandria shone like a sun in the constellation of lesser stars, in regard to learning and civilization, yet wherever Hellenes became scattered they carried with them their love of science ; and it was especially the flourishing town of Pergamos, on the Black Sea, which distinguished itself by scientific eminence in that early period. Besides an extensive library, King Attalus Philometer (died 133 years before Christ) established a garden for poison plants and their antidotes, and for the same purpose a garden

was formed during the reign of Mithridates Eupater, of Pontus (136–63 years before Christ), while the patronage of these sovereigns was enjoyed by the two most celebrated rhizotomists of that time, Kratenas and the physician and linguist Nikander of Colophon.

Dioskorides, at the beginning of the Christian era, extended much these early researches, more particularly in regard to medicinal plants; and his work and that of Plinius continued for nearly seventeen centuries the codex of medico-botanic science, it being rich in observations gathered by the former while surgeon to the Roman legions, and it is consulted yet as an authority in the Orient. Dioskorides' work, as well as the writings of Aristoteles and Theophrastos, contributed much to the *Historia Naturalis* of the elder Plinius, who was so famed as an admiral, statesman and philosopher (23–79 A. D.). Plinius mentions that Antonius Castor, under King Dejotorus of Armenia, possessed a botanic garden at the time of Julius Cæsar.

From the famed surgeon Galenus of Pergamos, who much recommended the study of native medicinal plants, we have to pass through a long interval of comparative scientific darkness, in which phytology particularly shared. Useful plants were, however, in many instances cultivated by the monks. The medical knowledge of the Arabs was carried through the crusades to the Occident, and thereby new information of many plants was secured. The Benedictines, in 1309, formed, with the medical school of Salerno, also a medical garden. In 1333, the botanic garden of Venice was established as an institution accessible to the public. Lucas Ghini formed successively the

botanic gardens of Padua and Pisa in the first half of the sixteenth century. About that time also such institutions were organized at the Universities of Bologna and Pavia. Duke Alfons of Este formed one at Ferrara. Belleval was instrumental in the formation of the botanic garden at Montpellier, early in the seventeenth century. All these South European institutions are still in existence, and with most of them the one of our young colony continues in communication.

The elder Camerarius, in 1588, described his private garden of Nürnberg (Nuremberg) as "*hortus medicus et philosophicus.*" The University of Leyden provided its garden in 1577; that of Paris dates from 1633. Queen Elizabeth created the first in England at Hampton Court, of which Parkinson was the administrator. Bobardt was the first director of the Oxford garden, in 1632. The Bishop of Eichstedt formed one at St. Wilibald, under Besler, which gave rise to a descriptive work in 1613.

Peter the Great, amidst his enormously active exertions to regenerate his colossal empire, could still find time to create, in 1714, at his new capital, the great botanic garden which stands now amongst the foremost of all, notwithstanding the inclemency of an inhospitable climate. The Emperor, not unaccustomed to take counsels with philosophers, planned this garden on the advice of Leibnitz. The botanic garden of Edinburgh was already founded 200 years ago. Henry Nicholson gives an account of the plants of the Dublin medical garden in 1712.

But why do I enter on these historical details, many of which are almost buried in oblivion? I did this

because I wished to demonstrate that, from the early transcendental days of Greece up to the most recent decennia, all institutions designated as botanic gardens were mainly or exclusively devoted to the rearing of such plants as were adopted for medicine, for alimentary or industrial purposes; and it would be little short of relapsing into barbarism were we to alienate any such institutions of ours entirely from their legitimate purpose.

By way of illustration, let me offer a few words on recent eminent institutions of this kind. As one of the most important of all botanic gardens of the European continent may be instanced that of Breslau, founded in 1811, and since 1852 under the direction of my venerable friend, Professor Goeppert, who conducts his administration in accordance with the highest principles of science. I am not aware of the precise present contents of that rich establishment, but already in 1857 it possessed about 3,000 annuals, 4,000 hardy * perennial herbaceous plants, about 2,000 species and varieties of unprotected shrubs and trees, and about 3,000 different kinds of plants under glass. This garden is remarkable for its physiognomic groups, of which there are 84, and to augment these the tropical plants are placed from May till September in the open air. Unique in the Breslau establishment is the display of fossil plants, restored from original specimens, to exhibit them not merely fragmentary, but as much as possible in their pristine completeness. Carpologic collections are made from the living plants with the most circumspect and scrupulous care. The botanic garden of Munich was founded in 1809—at

* The latitude is that of London, but the climate is much colder.

a time when the horrors of apparently endless wars concussed the whole of Europe ; it was long under the surveillance of the deeply - learned philosopher and celebrated Brazilian explorer, Von Martius, whose memory must be dear to every one who was brought in communication with that great man. This garden contained in 1851, in its conservatories alone, about 5,000 species of tender plants.

If necessary, I might enter on long expositions concerning the workings and contents of the principal botanic gardens of former times or the present days; but I will rather at once define the conclusions, to which all these statistics or other comparisons would lead us, only yet premising that among all existing state gardens none can be compared to the grand and justly-famed establishment of Kew. While the highest scientific administration is there brought to bear, it is also seconded by the enlightened and commensurate support and the princely endowments of a great nation.

The objects of a botanic garden must necessarily be multifarious, nor need they be, in all instances, precisely the same ; they may be essentially modified by particular circumstances and local requirements, yet, in all cases, the objects must be mainly scientific and predominantly instructive. As an universal rule, it is primarily the aim of such an institution to bring together with its available means the greatest possible number of select plants from all the different parts of the globe ; and this is done to utilize them for easy public inspection, to arrange them in their impressive living forms, for systematic, geographic, medical, technical or economic information, and to render them

extensively accessible for original observations and careful records. By these means, not only the knowledge of plants in all its branches is to be advanced through local independent researches, conducted in a real spirit of science, but also phytologic instruction is to be diffused to the widest extent; while simultaneously, by the introduction of novel utilitarian species, local industries are to be extended, or new resources to be originated; and, further, it is an aim to excite thereby a due interest in the general study and ample utilization of any living forms of vegetation, or of important substances derived therefrom.

All other objects are secondary, or the institution ceases to be a real garden of science. But the detail interpretation of these fundamental rules may be more or less rigorous, as the extent of the operations thus designed must very largely depend on the natural facilities and monetary means which are at command for the purpose. Moreover, the early attainment of any of these varied objects must evidently be all the more difficult in a new country, where, in the first generation, we are passing yet through the laborious and expensive process of founding all those institutions from which, in the natural course of events, a later time can only derive the fullest benefit. But in all these planting operations, indicated for scientific demonstration, we can still find full scope for the display of tasteful ornamentation and picturesque grandeur.

A real botanic garden, then, ought to display the living vegetation in its multifarious forms, as far as ever local circumstances will permit. All the plants of the globe build up together a great harmonious sys-

tem in nature ; they are all referable to distinct, specific forms, all created by design of an Almighty power for special purposes ; they are, moreover, all endowed with well-defined qualities, all interesting and beautiful in themselves, and eligible for our varied wants. We may accumulate collections still more extensive for our phytologic museums than for our garden displays ; but we still need to study, as far as we can, the forms of the vegetable empire in their living freshness, their natural grace and their vital beauty. What can be more instructive than to compare allied species, from often widely-distant parts of the globe, when placed in culture side by side ? Or, what can be more impressive than to watch how, in succession, the specifically ever-unalterable forms unfold themselves before our view, or sink again into rest ? To accomplish great results in all these respects we have, in our climatic zone, enviable facilities ; and thus horticultural pursuits for strictly scientific purposes become also here far more grateful than in the countries of colder climates where most of us spent our youth. Remember only how, irrespective of the plants of colder latitudes, we can have, under the open sky around us, the plants of all the Mediterranean countries, Arabia, Persia, the warmer Himalayan regions, China and Japan ; how we can rear here without protection the marvellously rich and varied vegetation of South Africa ; how, in our isothermal zone, we can bring together the plants of California, New Mexico, Florida, and other Southern States of the American Union ; and how we need no conservatories for most of the plants of Chile, the Argentine States, and South Brazil. In Australia we require hardly to

allude to the singularly peculiar vegetation of New Zealand, or the gay, curious, and remarkably - varied vegetation of West Australia, because we are rightly accustomed to regard these neighboring colonies as portions of the great integral southern empire of Britain ; but it requires to have studied the vegetation of Australia and New Zealand specially to appreciate its richness, and to understand fully its value for a garden in a colony like Victoria.

Thus, for geographic and for systematic culture, both primary objects of a botanic garden, singular facilities arise to us here, and this I cannot better demonstrate than by some exemplification. South Africa possesses, for instance (according to Mr. Bentham's elaboration, issued by the elder De Candolle in 1839), about 400 real *Ericas*, many so long the charm of European green-houses, and there are about 100 more of Cape Heaths, though not true *Ericas*. Collateral to the Cape Heaths, and not less handsome, are our own *Epacrideæ*, with about 200 *Styphelias* and generically allied bushes, and again 70 capsular species of *Epacris* or cognate genera. Professor Harvey and Dr. Sonder, in their great work on South African plants, describe about 50 *Muraltias*, 70 *Hermannias*, over 100 species of *Oxalis*, about 150 species of *Aspalathus*, and at least 150 Everlastings ; among the latter alone, 137 veritable *Helichrysums*. The Australian *Immortelles*, largely from the West Coast, are in some instances still more lovely. They amount to more than 100, among them about 50 *Helichrysums* and 30 *Helipterums*. This calculation leaves Everlastings of other orders, such as *Ptilotus*, *Laxmannia*, *Calectasia*, etc., uncounted. Of all these, as yet comparatively very

few have found their way into our own gardens, although these plants would need here singularly little care. Still less horticultural attention is essential for the wonderful variety of succulents with which South Africa teems. You may have seen, Spring after Spring, or Summer after Summer, the gayness of at least a few species of *Mesembryanthemum*, unfolding under the sun of our clear sky a dazzling brilliancy of starry flowers, on which the eye is almost unable to rest. Of these *Mesembryanthema* nearly 300 species exist in South Africa, mere varieties uncounted. But the array of succulents does not end with them. There are also a quarter of a hundred of *Cotyledons*, no less than 100 *Crassulas*, more than 100 *Stapelias*, about 160 kinds of *Aloe*, several *Kleinias*, cactus-like *Euphorbias*, and a good many others, all highly desirable for scientific garden collections, some quite paradoxical. Thus, South Africa alone gives us nearly a thousand succulents, many, I fear, under the progress of settlement doomed to absolute annihilation. When speaking of succulents, hardy here, I do not comprehend among them the generality of *Cacti*, of which it is assumed that about a thousand kinds occur, all, with one exception, American, mostly, however, intra-tropical; yet also many of these do not demand protection under our sky.

I cannot extend these details much, but our means of communicating with the Cape of Good Hope are seemingly on the increase, and so our facilities of acquiring; more particularly since Her Majesty's representative will now also prove a dispenser of generosity from thence. I may, just in passing, remind you of the existence of sixty *Phylicas*, nearly as many

Asters, Sphenogynes and Athanasias, and three times as many Senecios (the latter including the pretty *S. elegans*), none of all these coming amiss to a botanic garden. There are over 100 Indigoferas, many of them very handsome plants, in South Africa, none, I believe, ever subjected to the trial whether pigment can be obtained from them.* There are many Podalyrias and other leguminous bushes, which a horticulturist here may well covet, when we see how much the few species hitherto introduced already contribute to the Spring glory of our gardens, and how completely they are able to cope with the vicissitudes of our climate. As for bulbs, they also attain their maximum in South Africa; this a glance at the bulbous flowers of any garden will testify; but we know little yet of the Lilies and numerous other flowers of California and Texas, in a horticultural point of view—many modest, it is true. New transpacific communication has lately brought these with their floral companions also within our easy reach. The heath-like Diosmeæ of South Africa, all charming bushes, number (according to Dr. Sonder's disquisition) 170; *Agathosma* alone counts 97 species, of which hardly any yet are existing here. These pretty plants, which cannot sustain themselves out of doors in the inclement northern countries of Europe, we surely should like to grow here, along with our Australian diosmeous Rutaceæ, in gay array, for pleasing contrast, or systematic and geographic comparison. If we also add the superb Australian Diosmeæ (*Boronia* and *Zieria* 67, *Eriostemon* and allied genera 66), we ob-

*A search for dye in our native Indigofera gave negative results. We know, in all, about 250 Indigoferæ, none European.

tain over 300 kinds of this admirable tribe of plants to select from.

The Proteaceæ of Australia and Africa might also be considered together, as they belong to the same climatic regions, and might here be reared alongside of each other. Professor Meissner admits nearly 250 South African Proteaceæ, among them about 60 Proteas, 50 Serrurias and 50 Leucodendrons, the latter including the Silvertree of the Cape. Undoubtedly this is a remarkable wealth of Proteaceæ, an order now only occurring in fossil forms in any part of Europe; but, through my aid, and in sequence of prior researches (chiefly of R. Brown and Meissner), it has latterly been shown by Bentham that Australia is still richer in these plants, as it can pride itself on no less than 576 Proteaceæ, among which Banksia and Dryandra, united, count 93 species, Petrophila and Isopogon together 64, Persoonia 59, Hakea 95, and the genus Grevillea, which is familiar to all of you, 156 species; 30 Grevilleas having been added by my independent researches, instituted chiefly in the Melbourne Botanic Garden. Is it not of far greater instructiveness and importance to secure as many of these mostly rare and local plants for a true botanic garden, than to spend the same amount of exertions and outlay on numerous varieties of ordinary florists' plants, which almost every private garden already possesses? Is it not far more worthy of the objects of a botanic garden to gather for instance the 143 pretty Heath Myrtles, chiefly of West Australia, which in their simple beauty cannot be surpassed, than to strive incessantly to add hybrid flowers to those of our garden-plots, or to acquire some probably unmeaning

new varieties, however delightful to the eye, yet perhaps only slightly larger or tinged rather differently to those which we had before? Let us, according to our means, extend our patronage to all that is brilliant as a mere flower, but not to the exclusion of grander aims. Of the charming *Darwinia* we might secure 23, some most exquisite; of *Verticordia* 37; of *Calycotrix* 34; of *Thryptomene* and other Heath Myrtles 49. This brings me to the allied *Bacckeeas* with 54 species, the splendid *Calothamni* and *Beaufortias*, both together 45 species; *Melaleuca* and *Callistemon* 107 species; *Leptospermum*, *Kunzea* and allied genera with 57 species. Numerous of the Heath Myrtles found their first elucidation in the Botanic Garden of this city. But be it well understood that I do not wish altogether to discard the gorgeous acquisitions, which we owe to patient horticultural skill, even in a botanic garden. Let me, as an instance of phytologic requirements in this respect, adduce the genus *Pelargonium*. Its hybrid forms are now uncountable, and I should be sorry to banish these gaudy plants; still, 160 specifically distinguishable *Pelargonias* exist in South Africa, their main geographic area, and I shall sadly regret if the pure original and at the same time attractive and lovely forms of the genus, from which the garden hybrids all gradually sprung, were to be entirely superseded in preference to the latter.

“First follow nature, and your judgment frame
 By her just standard, which remains the same.
 Unerring nature is divinely bright,
 One clear, unchanged and universal light;
 Life, force and beauty must to all impart
 At once the source, the end, the test of art.”—POPE.

But is it necessary to dwell on all this so long, when the bearings of botanic gardens on industrial pursuits are mainly to engage our attention for this hour? It is, because a great multitude of foreign plants, never yet introduced, or not yet generally recognized as valuable, might be made subservient to horticultural and other industries. A rich assemblage of rare plants becomes a great treasure in our climate, simply by the yield of seeds; or by affording the means for multiplication by cuttings or otherwise, the yield to become thus readily available for horticultural trade here and abroad; while many of the handsome shrubs of our garden-grounds do not produce seeds in the conservatories of colder lands. I fancy that a square mile or two of heath-ground, well selected, and within easy access of railroads, could, in a climate like ours, be converted into a place of the utmost attraction and instructiveness, by bringing together and naturalizing on such a spot all the gems of the heath vegetation which South Africa, our own continent, or the moorlands of the Andes, the Himalayas, and other countries produce. But not only could such a spot be decorated with the utmost profusion of gaiety and loveliness,* but it might, as pointed out, become also a source of great pecuniary gain, merely by the annual gathering of seeds from such a mass of rarities. Instruction from a botanic garden assuredly paves the way for purposes like these.

Would it not be of great importance to our artisans to see the 130 species of Eucalyptus, as the principal timber-trees of this continent, all represented in a

* For instance, above 100 species of Sundews could be brought together there.

state garden here? About 50 of these were rendered known to science by Melbourne researches. Imagine the glory of some of these trees, when—as in the instance of *Eucalyptus miniata*—they are loaded with trusses of orange-colored blossoms; or when, as in the instance of *Eucalyptus phœnicea*, a tree of this genus produces crimson flowers vieing with the Ratas of New Zealand, but shows an infinitely easier growth.

We should promote the cognizance of the timber, not merely from museum specimens, but also as much as possible from the living trees. In a young country, particularly, our energies should be concentrated on instilling information in this way. But a tree planted during the early days of settlement, if thoughtlessly sacrificed in a moment, or allowed to perish from inacquaintance with its nature or value, cannot be restored to its attained size, even if replanted, before the end of this century.

As yet we know but little of most Oaks, as far as technology is concerned. We should watch their growth in various geologic formations; we should note their adaptability to certain climatic regions. About half a hundred kinds have been brought together here by myself, but there are 300 kinds in different parts of the globe to select from. *Quercus Lusitanica* has shown itself here one of the most eligible for avenues, on account of its rapid growth, its protracted verdure, and complete umbrageousness.* Our Eucalypts are as eagerly tested and watched elsewhere, as we ought to ascertain the effect of our clime on introduced timber trees. Our Blue Gum-tree will still grow from Toulon to Nice; at Cannes the tender branches are

* ▲ variety of this species yields the nut-galls of commerce.

frozen. At Golf Juan the tree does not suffer. It comes within our observations in a scientific garden why wood is more durable when produced on certain spots, as compared to that of other localities, and in a similar manner should be carried on undisturbed utilitarian research in manifold other directions. One single plant of a tree, once obtained, can become the progenitor of vast plantations. It is no exaggeration when I say, that from a single imported Asiatic Ash 15,000 young trees were obtained by me for Victoria, and that from a solitary Tamarix-plant 20,000 bushes, now scattered through our colonial shrubberies, took their origin.

It should be ascertained how many of the 160 true species of Willows and of their numerous hybrids are available for wickerwork; and we should learn whether any of the American, the Himalayan, or the Japan Osiers are in some respect superior to those in general use. We are aware that the Sal (*Shorea robusta*) is hardier than the Asian Teak (*Tectonia grandis*), the latter naturally not thriving beyond the tropic circle; but we are not aware whether the Sal will live in any sheltered forest clearings of Victoria, and how far the Sisso (*Dalbergia Sisso*), which is hardier still, and which, according to Colonel A. Crawford, stretches to the thirty-second degree, north, in the Punjab, can be adopted as a forest tree for this colony. In solving such questions, a scientific garden may afford material aid. We should like to see how far Californian Redwood-trees (*Sequoia gigantea*), or New Zealand Totaras, may give us good timber, when merely grown from cuttings in the open air.

Test experiments, initiated from a botanic garden,

might teach us whether the Silk Mulberry-tree can be successfully reared in the Murray desert, to supplant the Mallee-scrub, or what other utilitarian plants, such as the Fig, various Coniferæ, Tanners' Wattles,* grasses, etc., we may gradually establish there.

Numerous Pines and other industrial trees have been secured for this country, not merely in a few specimens, but in large masses. The Nut Pine of Nepaul is brought thus at last before you. The King Pine or Dye Pine of the Himalayas I raised by tens of thousands; but even if we had them by hundreds of thousands through our moister and higher ranges, it would not be too much. When even a bundle of firewood on some of our diggings costs already some shillings, the question of timber and fuel becomes also to us one of constantly-increasing moment, and thus, in a botanic garden, we should also give to this grave question some practical and enlightened attention.

As regards deal wood, which naturally not occurs in our ranges, you will be cognizant that, within the last few months, more was consumed by the flames, raging through many of the forests of Canada and the United States, than would have sufficed to supply Australia for a generation.

Again, I cannot imagine anything more interesting than a full collection of Acacias, of which Australia alone furnishes (*Albizzia* and its sub-genus, *Pithecolobium*, included) 300 species, all hardy here. What delight is experienced when, as the first harbingers of Spring, the early wattle-flowers burst into bloom, converting bushes or trees almost into one mass of

* Good Wattle-bark is three times as rich as Oak-bark in tanning principles, and much quicker produced, and that in localities where no oak will thrive.

gold, and diffusing fragrance widely through the air. To me 300 Acacias appear far more valuable than 300 varieties of particular fancy flowers, at least in a young botanic garden, where their names, their native countries, and perhaps even the uses of many could be learned. From the arborescent species of Wattles we might secure, by a judicious selection for copious planting, successively through all seasons, masses of flowers along whole tree-lines or copses. Thus our Silver Wattle (*Acacia dealbata*) early unfolds its flower-trusses on river-banks; then follows our Golden Wattle (*Acacia pycnantha*), to be succeeded by the spreading Willow Wattle (*Acacia saligna*) from Western Australia, and this, in turn, gives way to the flowers of the Black Wattle (*Acacia decurrens*) on our ridges; while the Blackwood-tree (*Acacia melanoxylon*), as well as *Acacia implexa*, *A. penninervis*, and many others, bloom later in the season, to keep up this imposing and grateful floral display, while *A. retinodes* remains ever flowering all the time. But, for industrial purposes, many of these Acacias become of far more than ordinary interest. Catechu, tanners' bark,* gum, galls, scents, and woods of various qualities are obtained from them; others serve for hedges; but, as regards oddness and strange diversity of foliage, there is no other genus in the wide range of the vegetable empire which is equally remarkable. The harvest of seeds from such an array of showy plants of easy growth is usually most copious and valuable in itself. For scientific and yet gay aggregation the native genera *Pultenæa* and *Daviesia*, both familiar to us here, offer respectively 75 and 55 species; Hibber-

*From which a concentrated extract may be prepared.

tia (including Candollea) furnishes over 80 ; Thomasia, with Lasiopetalum, together, 50. I instance all these as grateful plants, enduring hot winds, and yielding seeds in copiousness for easy growth. Again: Oxylobium, Chorizema, and Gastrolobium (if considered together as emanating from one general typic form) amount to 74, all beautiful, and some, especially the West Australian species, quite singular in foliage.

Turning to genera, numerically large in species, from which a botanic garden can copiously select for its conservatories, I might adduce Begonia. Professor Alph. de Candolle defines, by his recent masterly essay in the *Prodromus*, the characteristics, carefully elaborated, of not less than 380 species ; how far this number will be augmented, when once the mountain jungles of the whole of tropical Africa shall have been explored by phytographers or trained collectors, is quite beyond our surmise.* Even the infra - alpine regions of New Guinea and Borneo may add considerably to the number, and so, perhaps, even may yet Begonias be obtained from the unascended Mount Belenden Ker of North - east Australia, into the jungle fortresses of which, as yet, no breach is cut. If we once possess any of these decorative plants, mostly well adapted for window - culture, we can propagate them with the utmost ease, even from a mere leaf. Such plants, irrespective of their geographic interest, are important also, when the functions of a botanic garden toward horticultural industries are to be considered. The cultivator is glad to have fixed the botanic names, and to know the respective native countries of the different species, particularly when, as in

*Dr. Hooker has since published 24 new Begoniæ from equinoctial Africa.

this case, the genus ranges throughout the tropics of nearly the whole globe.

The epiphytal Orchideæ, which are the glory of all tropical jungles, from whence collectors can bring them away bodily with the greatest ease, are numbered by thousands. In the magnificent Belgian "serres" of Monsieur Linden are brought together already not less than 1,200 species of these wonderful plants.

While such a collection is a gem in itself, a reward of circumspect toil and triumph of superior horticulture, it at all seasons charms even the plain observer, either by the bizarre forms of flowers, or by their gaudy coloration, or by their imitative resemblance, or by their curious mode of attachment, whether to walls, rocks, wickers, fern-stems, logs, or any other substances.

Such an assemblage affords at all times ample material for original study and designing art, while its contemplation raises the taste and standard of horticulture, and instills an amount of information which ordinary decorative cultivation fails to convey; indeed, a botanic institution should aspire to these higher aims. Again, to the proprietor, such a collection, by its increase in masses, can also become, commercially, one of quite a lucrative gain. Hence I allude to this specially in this industrial hall.

Perhaps it is not too much to assert that every one of the existing ferns is worthy of cultivation. The delicacy and gracefulness of most is proverbial; the rearing of the majority is not surrounded with difficulty, even from almost invisible spores,* while pter-

*Imagine that a Fern-tree, possibly as high as the Museum Hall, can be raised from seeds so extremely minute that millions of them would not weigh an ounce.

idologists have already unfolded the astounding number of 2,400 specific forms, numerous varieties uncounted (*vide* Hook. and Bak. *Synops Filic*). Yet recent searches over the small islands of the Samoan group have taught us how greatly this number of known ferns may yet be augmented, when once Central Africa, Borneo, Sumatra, New Guinea, Siam, and other tropic countries, widely unexplored, shall have been fully traversed. The *Angiopteris* presented to you here from North-east Australia extends its single fronds often to a length of 12 feet or even more.

Of Passion Flowers now already 231 are on systematic record, far the greater number from the tropical regions of America.* We possess, as yet, but few of these graceful plants, and must persevere in our efforts of acquiring more of them, as well for the open ground as conservatories. These plants are not only quite as gorgeous as any of those which the ephemeral tastes and fashions of the day have brought into prominence, but they are infinitely more remarkable and instructive, besides far more lasting and grateful in culture. Several species, more or less adapted to our climate, yield the granadilla fruits, which yet ripen in the tropics at elevations 6,000 feet high.

Almost every one, who possesses a plot of ground, maintains a garden in some form, or, failing this, rears a few window or veranda plants. But simultaneously, every one, as a rule, evinces a desire of acquiring some more accurate horticultural information, and of becoming acquainted with some item or the other of knowledge relative to the plants around him. This applies, with equal force, to the native vegetation, by

* Dr. Masters, in *Transact. Linn. Soc. Lond.*, 1871.

which we are surrounded anywhere. We can scarcely cast our eye on any object without meeting some flower or foliage, from the humblest moss to the proudest tree, about which an educated mind is desirous to be informed. A room, however modest, can be rendered more cheerful by a few flowers; the splendor and elegance which graces a ball-room would be deprived of much of its charms without floral gayness. What can be more lovely than the buds of purest white in bridal wreaths, when they adorn the happy brow? Who did not admire, in the fêtes for our charities, the garlands woven by tender hands, or the flower-bunches gathered with smiling faces? Or, if we wish to pay the last worldly homage to the departed dear to us, do we not seek for a few snowy blooms to press into the cold hand, or to carry to the last resting-place? In all the changeable events of this versatile life, whether the saddest or most hopeful, we are longing to find in the floral world some emblems for our joyfulness, as well as for our deepest grief. Ever sought, ever admired, at the happiest hours chosen as the silent interpreters of affection, and in the gloomiest moments as the symbols of woe, flowers seem identified with all the tender feelings and all the gentle sentiments of mankind. Can there be, then, more noble objects for our studies? or are we to rest satisfied with a mere instinctive recognition of their outer form, bare of real knowledge of any kind? One of the great objects which a scientific garden is to fulfill for whole communities, indeed, consists in elevating the traditionary notions or the simple conceptions of plants to scientific cognizance and the highest educational standard.

In the oldest hieroglyphics, in the sarcophagi of the mummies, in the Huenen burials, and, indeed, in all relics of the remotest antiquity, the historian has to trace plants, and is often led on by them in his archæologic researches. The physician must draw them hourly into use; the artisan, whatever may be his occupation, has daily to depend on them or their products; all our aliments are derived, either directly or indirectly, from vegetation; the very existence of the whole animal creation, indeed of man himself, is dependent on plants. There can be no wiser measure for general education than to afford the easiest opportunity of gaining, at least to some extent, a scientific appreciation of these faithful and cheering companions of ours through life. Mark, when reflecting, how intimately the knowledge of the living plants is connected with the product which they yield so beneficently for our wants. The artisan who constructs the building should be able to recognize in our parks the Spruce Fir, which furnishes him the deal for flooring; he would no less be interested in viewing — though here, perhaps, under glass — the Mahogany-tree, whose wood passed for years through his hands. The chair on which we rest, the flooring-deals over which we daily step, the pencils with which we write, the frames which inclose the pictures on our domestic walls — all these, and thousands of other things surrounding us, are yielded by the vegetable world, and can become the objects of intelligent reflection and industrial teaching. The bloomy imitation of tapestry, or the flowery embellishments of decorated walls or architectural elegance — do they not call, hourly, plants to our mind? In the painters' landscapes, in

the poets' ideals, are they not always among the foremost? And where can all this find a more vivid and a more easy interpretation than in a botanic garden, true to its purposes? Few, even of enlightened minds, ever think from how many different zones, from how many distant parts of the globe, all these materials of necessity and comfort have to be gathered. It is clearly the object of an institution, the meaning of which we now briefly discuss, to bring the sources of all these things before our contemplation, so that the observer may trace—by the impressive teaching of living forms, all mute, yet all telling a tale of their own—the origin of those vegetable substances with which the demands of our occupation or the enjoyments of life bring us in constant contact. But shall we rest here? Ought not our meditation, when leading us from lifeless material to the wondrous living forms of vegetation, bring us nearer, also, the ever-wise Originator of the world?

“All are but parts of one stupendous whole,
Whose body Nature is, and God the soul,
That, changed through all, is yet in all the same,
Great in the earth, as in the ethereal frame;
Warms in the sun, refreshes in the breeze,
Glow in the stars, and blossoms in the trees,
Lives through all life, extends through all extent,
Spreads undivided, operates unspent.”—POPE.

The large collections, then, in a botanic garden, whether of growing plants or of museum material, are not amassed without serving important purposes, and not accumulated merely to satisfy transient curiosity. This may be shown by facts of vast number; let us note one or the other in testimony. As indispensable auxiliaries we want nowadays, for studies in a botanic institution, manifold collections, which, in fact, must

emanate largely from the garden itself. For the full utilization of such collections we need, moreover, to maintain a laboratory and ateliers of other kinds, to turn the riches of a really botanic institution to applied account. Besides, we require to fix all observations by lasting records, and render them, by issued volumes or by illustrations of pictorial or plastic art, accessible at all times. No sooner does a seed-grain germinate than it can be utilized for research. The great De Candolle gave us, in his *Memoires des Legumineuses*, the results of his observations on the embryonic development of one large tribe of plants. The writer commenced to trace the germination and early development of Eucalypts and some other plants, to gain in intricate cases of affinity additional data for diagnosis, and these kinds of researches admit of the widest extension in manifold directions. Be it remembered, for recognizing the multiplicity of material, that our choice for culture in this clime is from 30,000 out-door species alone, even if varieties are left altogether out of consideration; and how much varieties represent in number may be recognized in the contemplation of the culture forms of a single species of Rose, Verbena, or Dahlia. You may perhaps reckon on 3,000 species of trees hardy in Victoria, 7,000 shrubs, 12,000 perennials, and 8,000 annual herbs—grasses and rushes to be counted with the two latter. After such an immensity of hardy material has been selected from for cultural research, we have not yet allowed for the endless number of plants, which we can shelter under glass protection, the extent of hospitality thus to be afforded to delicate strangers being simply depending on the monetary endowments which

at any time or place may be at command. The total of Australian Dicotyledoneæ hitherto ascertained to exist is 6,500; and although, in some instances, the supposed species will collapse, there will be also some compensating access from new discoveries. The number of Monocotyledoneæ is also comparatively great. Should we not largely surround ourselves with our own native plants, handsome and instructive as they are? The range of cultivation in our state garden has, at times, been already extensive. In 1865, seeds were collected of 700 species of trees and shrubs in the garden; seeds also of 170 kinds of grasses, of 1100 herbaceous plants, and of 80 species of ferns. Many of the species thus raised became also amply dispersed. It is not too much to affirm that, during the many years of my directorial administration of our young establishment, hardly a day has passed without some industrial plant having been distributed, and information on its rearing and uses having been afforded. The increasing population demands increased attention. I have just spoken of the thousands of native plants, recorded in volumes of our own; they gained at least a share of their contents from locally-cultivated plants. Let me ask whether we should not find the principal plants of our own continent brought before us in cultivation, for systematic as well as other studies? They are, indeed, excellent indicators of climate, of geographic features and geologic structure. You all have heard, for instance, of the *Polygonum* swamps, so often referred to in the works on Australian exploration. Assuredly it is of interest to possess in a botanic garden the tall, wiry bush, which occupies, in intricate masses, the clayey mud-flats of

the interior, and which indicated to many a traveler, when almost perishing, the place of relief. Should we not be able to show in culture the poisonous herbs against which the squatter as well as the explorer must guard? Of the 110 salt-bushes of Australia, some are ascertained to be eligible as culinary esculents; the majority of these plants are of high value for sheep-pasture. These, with other salsolaceous plants of other countries, I should certainly like to see well represented in a scientific garden, as well for instruction as for test. Very many plants can be best examined for characteristics when in living freshness. The number of Australian Villarsisæ known to R. Brown, in 1810, was only two or three; chiefly through my own exertions we are now acquainted with seventeen; the delicate and often fringed membranes of their flowers, while they deliquesce in museum specimens, can be seen in our tanks at a glance. You can recognize the loveliness, and, above all, the irritability of the stylidia, of which we doubled the number since the time of R. Brown,* only, in the living state, the column of the flower snatching over at the least touch—a fact which even the keen eye of the natives seems to have frequently overlooked. It was largely through the exertions of our botanic department that the twelve species of Myoporums and Eremophila, recorded in R. Brown's *Prodromus*, were advanced to sixty in number; and it was through similar scientific exertions that the seventy Goodeniaceæ became increased to one hundred and eighty, the majority highly deserving of culture, and many available for medicinal use.

* Now nearly 100 stylidia are known.

The command of large collections of museum plants, commenced by my personal field exertions more than thirty years ago, gave here local advantages for affording also to correspondents in other colonies a fuller insight into the characteristics of the vegetation of their respective localities. Among those who availed themselves of such facilities for occasional consultation I count a gentleman of the Survey Department of Sydney, R. Fitzgerald, Esq., whose object it was to obtain, in doubtful cases, the names of plants for a series of drawings, prepared with ingenious skill and talent by his own hand. Ever anxious to lead such efforts into the best utilitarian channels, I suggested the publication of these illustrations in a weekly journal. With a readiness which reflects great credit on the scientific taste of the proprietors of the *Sydney Mail*, space is to be conceded for one plant at a time, as a preliminary issue in that valuable periodical, with an ulterior object of re-issuing the plates and descriptions in a connected form, as suggested in the first instance. Here, now, we have before us the first illustrations, to be followed, in regular succession, by others, an electro-plate to be used in final republication. It is superfluous to point out that such efforts will likely lead to imitation, and will instill an amount of lasting information, the extent of which we cannot calculate or foresee. From larger works, elaborated in great scientific institutions, devoted to the accumulation and study of plants, will always emanate special publications, and among them, in due time, local floras of each populous locality. The sedulous and ingenious zeal of Dr. Will. Woolls, of Paramatta, has thus already provided for the requirements of that

spot. To promote objections of this kind is within the legitimate pursuits of a botanic garden ; and it would be vain to argue that the interests of industrial artisans are not also involved in all these pursuits. I have a vivid remembrance with what an enthusiastic avidity many a student commenced his scientific collection of plants from gatherings in a botanic garden ; how he sought for correct appellations, traced the indigenous localities of any species, endeavored to understand the particular relationship of plants, and commenced to arrange systematically what he had gathered. Or I may have witnessed how the spare hours of a youth, eager for phytologic information, were spent, not in unprofitable plays or planless strolls, but among the flower-fields of free nature ; how he soon recognized any additions to his collections, and greeted any rarity or novelty with the outburst of absolute delight. Soon an impetus to more extended observation is given ; kindred spirits are drawn into co-operation, while recreative pleasures are advanced to sound philosophic speculations or applied knowledge, and thus, simultaneously, a pure fountain of never-ceasing joys, or an everlasting spring of utilitarian riches, is opened. Such was the first commencement of the luminous career of some of our great naturalists, and such was also the first origin of some of the most important museums of plants.

As means of education, the collections of a botanic garden, whether exhibited in their vivid freshness or stored for preservation and reference, may exercise a vast influence. It is not too much, when I assert that even the study of languages and geography, through scientific garden plantations, may be foster-

ed, and this in a manner more pleasing than in most other forms, just as numismatic collections are among the most lucid and impressive exponents of both history and geography, irrespective of ethnologic and linguistic researches; so much so that coin cabinets, as auxiliaries for superior teaching, should not be wanting in any leading pedagogic establishment.

A few plants speak often more strikingly for the nature of a country than a mass of pages of descriptive explanation; or a handful of flowering branches gathered on an unknown shore indicate often at once capabilities for rural productiveness and settlement.

No less important is the relation of plants to geologic structure and climatic conditions, and we must insist on the collateral study of all these branches of discipline in the true spirit of the great writer of *Cosmos*, if we wish to assign to the knowledge of plants its true value. Only within the last weeks it fell to my lot to demonstrate, from material placed at my disposal by the secretary of the Mining Department, that in perished forests, where now the town of Had-don stands, deeply buried under superincumbent strata, once lived in this very colony a tree, closely resembling that of the Satinwood of the hottest part of India (*Chloroxylon*).

I have heard it often remarked by thoughtful and circumspect visitors, when they passed through our Botanic Garden, that now, for the first time, they had learnt from whence naturally came some particular plants, which they had reared for years at their dwellings; or that they had remained until then unaware of the name, or the native locality, or any other knowledge concerning plants with which they had by

sight long been familiar. Perhaps, even, it is not too much to contend that no observant visitor can pass through a scientific garden, be it ever so often, without taking with him in each instance some new, instructive information.

All this must largely bear on technology. Unquestionably any intelligent mind is pervaded by the idea that the study of plants must have important bearings; but often this is only a vague impression, and very few may really have a comprehensive persuasion of that actual relation which exists between botanic inquiry and utilitarian application, even of the current day; much more difficult then must be the recognition of all that which is only foreshadowed in a dim future. And yet we cannot cast our views around us without meeting, in every direction, objects derived from vegetation, if not plants themselves, drawn into applied use. From the strong beams of a building, or the tall masts and weighty planking of a ship, to some of the most delicate articles of turnery, we see brought before us woods from often widely-distant countries; or we notice, from the stout ropes of rigging to the most tender threads, woven into wearing apparel, the utilization of basts from plants, which perhaps flourished in different zones and were reared by different races. What can be more instructive, then, and what can more readily lead to new local industries, than a special display of such fiber-plants, or any other group of utilitarian plants, in distinct areas of a botanic garden, where we may view them all at a glance, and from whence they may become disseminated? The work of a botanic institution for such purposes should, however, not be lightly dis-

turbed, its means scattered, or its collections imperilled. It requires much watchful toil and research to bring together the material for large instructive collections, which, if even only in part sacrificed, cannot be completed again without both laborious care and renewed expenditure.

Here in this hall I would ask, is it not the artisan who is specially interested in such collections? But the efforts to furnish or extend such means of teaching should not be ennarrowed by bondage, nor be discouraged by want of appreciation and sympathy.

To exemplify yet somewhat more the duties which devolve on a botanic garden, for attaining the various objects set forth, it may be instanced that its administrator must be extensively acquainted with the known vegetation of every part of the globe; he is thereby enabled, in his scientific relation to correspondents in all civilized countries, to secure by interchange or otherwise additional treasures for the institution intrusted to his care, and he is thus armed with the capability of recognizing the real value and significance of the riches which in his institution are already accumulated. He further must be conversant with the nature of his new acquisitions, to assign to them their scientific place in his collections, to identify them for ascertaining their names and properties, and to provide for them the varied requisites for their culture, which he alone can fully understand. Only by long professional studies, which qualify for the administration of a scientific garden, is it rendered possible to discriminate between the known and unknown, to record new physiologic facts, to circumscribe additional genera and species, to trace out novel qualities,

whether medicinal or chemical, whether technological or rural. Information by these means will necessarily exercise its influence in a professional department, and the reflex of this influence will be the diffusion of special knowledge in a manner best adapted to the requirements of time and place. So far, the path seems clear enough, yet grave obstacles may arise to impede or frustrate the progress; the means of an institution may be quite unproportionate to the ever-increasing demands made on it, and the whole of an establishment may suffer in the inadequate struggle. Natural difficulties may supervene, occasional droughts or floods may imperil or destroy the work of years. There may not even be water from inexpensive sources to irrigate arid declivities, or to convert rocks into spots of fertility. Quiet, unostentatious arrangements may in many other ways be marred, not to speak of the impossibility of coping with the elements. Well-matured plans, involving years of preliminary action, may become suddenly overthrown; and the detriment thus sustained is then not only one of the institution itself, but one of whole communities, or perhaps even of science at large.

Unfortunately, it is not everywhere that the originator of a horticultural institution for botanic purposes can exercise his judgment in the choice of the area; he finds it, as a rule, selected beforehand, and to the advantages of ready access of the multitude most other considerations have to give way. In an ideal perfectness of a botanic garden we would seek to possess the utmost diversity of soil — from the heath-moors to sand-drifts, and from rich clays to humus deposits; and we would wish to have within our reach

geologic rock-formations of various ages. But how rarely are such advantages attainable in one area! Local climatic influence will also frustrate largely cultural successes, without costly artificial means for imitating the conditions on which the growth of many a plant entirely depends. Few botanic gardens have, in this regard, the rare facilities of the one of Buitenzorg in Java, which, in its several branch establishments on the slopes of a high mountain-range, enjoys the means of bringing to perfection as well species bathed in the vapors of the hottest tropical jungles as also such as only prosper on alpine heights, or such forms of vegetation as withstand the vehemence of icy storms or the rigor of protracted burials under snow, and all this in a comparatively close proximity.

When an important plant has once been introduced or tested, a task in which a botanic garden must always take a leading share, then rural enterprise and private capital are expected to advance the cultivation and utilization of such a plant to commercial dimensions; or in particular cases, the State may fairly aid by affording the necessary special means for successfully establishing such a plant as a new source of wealth to the country. I wish we could here do for the Tea-plant what the governments of British and Dutch India have done for the formation of Cinchona plantations in the warm, temperate regions of the Indian mountains. The officiating Director of the Botanic Garden of Calcutta, C. B. Clarke, Esq., M. A., gives, in his report of April of this year, the number of Peru Bark plants in the Bengal Government plantations as 1,741,474, irrespective of seedlings and cuttings in the nursery plantations. The established

plants on Government ground of *Cinchona succirubra* (yielding the red bark) numbered then 1,233,715 ; those of *C. officinalis*, 440,000 ; other species existed in smaller number. Be it remembered that this new culture was commenced in British India only a few years ago. But there large sums are specially granted for this new branch of industry, which sums, if we consider the cheapness of Hindu labor, would need here, for similar purposes, to be proportionately enlarged to secure equal successes. For the thousands of *Cinchona*-plants, kept in my brush shades, as yet the reservation of the needful mild forest plots, and the special fund for the maintenance and the multiplication of such plants in the woods, has to be obtained. The yield of seeds by *Cinchonas* is abundant after a few years, and by these means the subsequent increase of the plantation is easy, and not involving large expenditure. To private settlers in our own forest-gullies and in the other Australian colonies *Cinchonas* have been furnished ; in open gardens near Sydney a few scattered plants have flowered this year, they being in that genial climatic spot not imperilled by frost.

If the Tea-plant, both of China and Assam, was first of all largely raised in Australia by myself ; if I placed it before the public in its growing state ; if I drew, repeatedly, attention in public documents to the importance of its culture ; if I prepared the first samples of Australian Tea in our Botanic Garden for great industrial exhibitions here and abroad ; and if, moreover, I annually distributed Tea-plants, and even seed, to an extent not altogether inconsiderable, then I do think that I may rest satisfied of having fairly carried

out my duty ; I cannot step beyond this. Private enterprise and commercial capital must do the rest to advance also this culture here to industrial dimensions. The long - continued prejudice, that Tea cannot be cultivated with mercantile remunerativeness beyond the boundaries of China, has at last been overcome in the Southern States of the American Union, where a commencement has been made with the production of Tea from indigenous fields. At Assam, also, Tea is, since some years, largely cultivated by English planters, to one of whom, Mr. Bruce, formerly of this city, I am under obligation for his disinterested liberality of providing seeds in large quantity at my solicitation, while I owe the first large consignment of China seeds to the generosity of Sir Hercules Robinson, who sent it about a dozen years ago on my application. I fancy that Tea plantations, even if made in first instance only for raising local supplies of seeds, would be profitable, the transit from China or Assam being difficult on account of the short vitality of the seed.

It is well known that, in China and Japan, hitherto, with an unalterable obstinacy to any changes of method, the preparation of the tea - leaves is carried on by primitive processes of unaided manual labor, without any mechanical appliances of machinery. But what would be the onward course of literary intelligence if we had still to adhere to the original manual operations under which writing and printing paper was produced, or if we had continued reluctant to adopt the mighty steam - power, to speed and cheapen the production of print, when nowadays even the simple folding of printed sheets is rapidly done by machine-

ry. Beet-sugar, at its present price, could not possibly be produced without the steam-engines of factories; and there is nothing to prevent us to call that great mechanic agent also to our aid for heating and curling Tea-leaves. Also, in this respect, we must emancipate ourselves from foregone conclusions.* The demand for Tea, as a commercial commodity, is something astounding. The importation into Britain alone has been latterly about at a value of ten millions sterling annually; the consumption is even rapidly increasing. The process of establishing Tea-fields is simple and easy. In North America the plants are placed six feet apart; each plant yields about one pound of tea annually, or about four pounds of fresh leaves; the gathering extends over about six months there. To foster Tea-culture is to advance the great temperance cause.†

Foreign select Oaks, or rare and important Pines, may have been introduced by the thousand, and

* On explaining to Mr. G. Joachimi, C. E., of this city, all the details of preparing Tea-leaves for mercantile commerce, he has constructed, on my suggestion, an apparatus to be worked and heated by steam; this will require, according to his opinion, only two men for performing the work which, according to the present Chinese method, would occupy twenty-five men. The mechanism, so constructed, provides for cutting wood for tea-chests as a by-work.

† The imports of tea into the United States for some of the past years were as follows, according to Consul T. Adamson; viz., year ending June 30:

1856-57.....	25,292,100 lbs.
1858	29,255,300 lbs.
1859	30,173,100 lbs.
1860	31,662,400 lbs.
1861	28,189,300 lbs.
1867	39,692,658 lbs.

The importation of tea into Britain for the seven months of each year ending July 31st, was

1869.....	67,648,588 lbs.	value	£4,904,777
1870.....	79,384,477 lbs.	"	£5,263,836
1871.....	91,753,906 lbs.	"	£6,030,656

For the whole year—in 1864, £9,338,760; 1865, £10,044,462; 1866, £11,208,815.

legions of ornamental or industrial plants may have found their way from a botanic garden, directly or indirectly, into numerous cultural spots, and may largely contribute to grace already even many extensive parks; yet after all the extreme efforts of sedulous skill, and after an institution may have lavished its treasures with unbounded generosity, it still may find itself forsaken even by those on whom it had most claims. Here is before you the noble Dye Pine of Nepaul (*Pinus Webbiana*). It fell to my lot to raise it in Australia first of all in masses, more than 20,000 seedlings having been reared in my nurseries two years ago. But the growth of this noble Spruce is slow. It requires three or four years before a seedling is strong enough to be trusted out. For all the patient care thus bestowed, and for all the foresight thus displayed, there can only be results after rather a long while, especially if even the facilities for culture are locally much impaired. Moreover, it is in the forest-lands only where numerous plants, which I have introduced, can attain to perfection. It would, for instance, be hopeless to attempt growing the American Cranberries, Huckleberries, or Blueberries, or the English Whortleberry, in the Melbourne garden, with a prospect of a copious yield of fruit. In our alps we have extensive sphagneta for many of these kinds of plant, but scarcely an edible fruit of any kind grows naturally on our snowy mountains. In Germany and some North European countries Bleeberries are brought as extensively to market as Strawberries. The Honorable the Commissioner of Agriculture for the United States, General Horace Capron, states, in his report for the year 1869, that the culture of the American

Cranberry (*Vaccinium macrocarpum*) is annually much increasing in some of the States; boggy sands of the savannahs, cleared of Cedar brushes (*Taxodium distichum*), being chosen for this culture. In New Jersey about 1,800 acres are now in bearing,* and about 4,000 acres more were, up to 1869, planted with Cranberries. The profit on the capital thus invested is from 25 to 50 per cent. annually. One grower realized, in eighteen years, from only ten acres Cranberry land, a fortune of £40,000. In the United States many thousand people are employed almost exclusively in picking this and kindred fruits. In June commences the harvest of Strawberries; a month later follows the Raspberry; then comes the Blackberries; in August commences the gathering of Whortleberries; after that the picking of Cranberries is proceeded with, which extends to November.†

The miners, in prospecting through the ranges, might scatter the seeds of berries of those kinds along water-courses, or set out plants along rivulets or springy spots, from whence, when left to themselves, they would be sure to spread. The explorers of the interior, by strewing a few seeds of *Acacia lophantha*, *Casuarina quadrivalvis*, or some Eucalypts over their camping-ground, might yet more permanently indicate these bivouacs than even by burning or cutting letters in many trees. In all this a botanic garden has a fruitful field for exertions. I endeavored to naturalize the medicinal squill on our sea-shores. Lately the American species of Sumach have come in

* Producing 150 000 bushels in 1869, worth 12s. per bushel, therefore £90,000 the year's crop in that small State.

† *Gaylyssacia frondosa et rinos* (American Huckleberries). *Vaccinium vacillans*, *Pennsylvanium et corymborum* (Blueberries).

successful competition with the Sicilian Sumach, the species from which gatherings are made in the United States being chiefly *Rhus glabra*, *Rh. typhina* and *Rh. copallina*—all rich in tannic acid—all to be seen in our botanic garden. In translocations of this kind, which, under the sanction of usage, we are accustomed to call acclimation, we are expected to take a leading share; the former is the apter term, inasmuch as the possibilities of changing constitutional endurance to clime are restricted to narrow bounds. I should have spoken of the uses of a botanic garden as a horticultural school; of excursions to emanate from it into the flower-fields of the near environs; of the aid which ours has afforded to provide the festive boughs and decorative flowers at thousands of *fetes* for our charities; but our time has drawn to a close. I intended to have also spoken of “the marvels of vegetation” which it might display, but must reserve this theme for a special lecture. Still this I would say, that all teachings should be in such a form in our own state gardens as not to encroach on the functions of our famed University, which has made already early and special provision for phytologic instruction.

For toxicologic experiments in a botanic garden the various poison plants become of importance, irrespective of the guardianship which the display of these plants in a living state so instructively exercises. Investigations of this kind require lengthened attention, the separation, analysis, and identification of organic poisons being surrounded with far more difficulty than the examination of metallic or other inorganic substances. Beside, the development or intensity of the deleterious principle depends often on local causes,

which are not always within ready range of observation, or, perhaps, even involved in mystery, such as physiology and chemistry have hitherto striven in vain to clear away. The so-called Cape Weed, for the presence of which I am not responsible, as it had already irrepressibly invaded some parts of Australia as early as 1833 (*Cryptostemma calendulaceum*), was recently subjected in my laboratory to examination, with a view of ascertaining whether any chemically separable active principle might produce the violent purging, terminating in acute and often fatal dysentery, to which flocks occasionally become subject, but the investigation gave negative results. The deleterious effect arises, therefore, either merely from mechanical irritation and distension, when sheep have gorged themselves with this weed, or it may be traceable to a locally-developed poison, which, in ordinary circumstances, does not exist. The latter was ascertained to be the case by my own experiments as far as *Swainsona Greyana*, *Swainsona lessertiaefolia*, *Lotus Australis*, *Gastrolobium bilobum*, and, perhaps, *Stypandra glauca*, are concerned. The two former cause in some localities cerebral affections in horses and other pastoral animals, terminating in death; but the cultivated plants were found harmless. *Gastrolobium*, with some species of *Oxylobium* and *Isotropis*, the bane of the heath pastures of West Australia, has hitherto baffled all efforts to detect an antidote, but one of the most dreaded species, *Gastrolobium bilobum*, proved here, in cultivation, inert. Desert specimens of *Lotus Australis* produced, in my local trials, deadly effect on sheep; while our garden-plant, or the fresh herb from the sand-shores of Port Philip.

showed themselves innocuous. *Stypandra glauca* is reported to produce complete blindness of sheep, in some districts of West Australia, the eyes, it is said, assuming a blue tinge throughout. Unless this grass lily has been confused with an allied and externally-similar weed—namely, *Agrostocrinum stypandroides*—we have again a plant which, with capriciousness, has hitherto baffled our toxicologic experiments. *Anguillaria* and *Burchardia*, which, early in the Spring, sprinkle their pretty blossoms so universally over the pastures of the whole of extra-tropic Australia, produce, so I have ascertained, innocuous bulbs, although belonging to a tribe of plants which includes the dreadfully-deleterious *Veratrums* and *Sabadilla*.

All this shows that an ample field for observation is also open for us in this direction, and this more particularly in a young country like ours. We are no longer in the earliest youth of our colonial existence, when the few scientific questions, arising then in very small communities, could receive, at long intervals, their answer from the urbanity of leading European authorities, on whose professional advice or scientific opinion Australia, however, had no claim. But, in the vigor and celerity of our colonial advancements, we can afford no longer to wait the many months which must elapse before, on every question, the needful scientific information is obtained from abroad. Indeed, as might be expected, the applications for advice to a botanic department are now of daily occurrence, and ever increasing with the population and its varied enterprises. A central institution for phytologic information requires to be maintained among us somewhere, whether in this metrop-

olis or in any other city of Australia may, perhaps, not be of great moment ; but, to build up such an institution for all these colonies, the local efforts here have not been altogether insignificant. The integrity of a well - constructed whole, on which so much forethought has been spent, should, however, not be lightly disrupted ; or a carefully - organized department, of whose meaning or obligations but few can really be aware, should not be suffered to be impeded in its progress.

A botanic garden which cannot afford to maintain at least one collector in the field must be regarded as a very imperfect institution, especially so in a new country. For brisk interchanges, particularly, such material is needed as has amply the charm of novelty. Should we not also take an honorable share in unfolding the natural productions of the globe, especially when novelties or rarities are here almost within our grasp, and when assuredly the investigation of such is calculated to advance as well the interests of technology ? The total of the territory of Australia, not yet traversed by exploration, may be compared in extent to the united areas of Britain, France, Scandinavia, Germany, Austria, Italy, Spain, Portugal, and Greece, and may therefore be estimated almost equal to extra - Russian Europe. It may be well imagined how eager the writer has always been to send emissaries into those wildernesses, more particularly while exploration and occupation progress. New forms of plants require to be elucidated, the range of the species needs to be determined, the geologic relation of the different specific forms has to be traced ; and it would be little short of blindness were we not to ad-

mit that industrial interests would be promoted at the same time. Even part of the unexplored coast of New Guinea is at no greater distance from Somerset, at Cape York, than Launceston from Port Philip, and yet there are on that coast, within sight, snowy mountains as yet unascended. Even if a collector from our botanic garden could be 'pushed into that grand island, we would perform legitimate and honorable work, and might attain great results at but modest cost.

In some parts of Europe the fashions of horticulture have recently undergone some changes again, so far as to render the growing of flowers in masses, or bands, or decorative figures less predominant, as this extremely artificial culture is giving way largely to the far more natural one of picturesque or scenic grouping. I advisedly do not apply to this system of planting the term "sub-tropical gardening," which is yet retained in the excellent book published this year by Mr. William Robinson, of Kensington, who has contributed by this and other works (such as the one on the gardens, parks, and promenades of Paris) so much to ennoble horticulture to simpler, natural grandeur, and lead it to higher scientific tastes.

With still less logical propriety can the appellation of landscape gardening be chosen for this process of scenic ornamentation or group-planting, as we comprehend something far more extensive by a landscape than the ordinary limited areas of gardens or even of parks. Call it whatever you like, this novel system is the very opposite of geometric or formal decorative planting; all these manners of culture have advantages of their own, more particularly in relation to

special circumstances and requirements, educational, experimental, or otherwise ; these various cultural systems might even in some instances and to some extent be advantageously blended ; but, while they may all be represented in a botanic garden, the formal decorative planting, or the cultures for exclusive ornamentation should there at least not prevail, but be made subservient mainly to scientific objects. Much, in respect to bedding flowers and other simply decorative planting may be fairly left to the gardens formed for private entertainment and pleasure. Consider, only, what is there to show after the season's expense and toil, when the gorgeous ribbons, of almost endless length, have faded away, or when the starry or other fanciful ornamentation has become blighted ? Undoubtedly there was magnificence, but it was transitory. True, portions of it will naturally revive—other portions may be restored with little cost, but the main restitution of such floral displays on a gigantic scale requires expensive renewals, for which the State means, more particularly of a young colony, ought, in early days, to be too precious. I hold that, in a public cultural establishment, even in older countries, its endowments are more legitimately employed by devoting them to produce works of permanency and utility ; not, however, falling into the other extreme of shutting out altogether ornamentation in its less expensive form. I further hold that attractiveness, in a young garden or park, should commence in providing for befitting fences, passable drives, reclamation of swamps, effective water-works, security against floods, shelter against storms, and the primary conversion of tracts of wilderness into useful and reproductive ver-

dure. We may gain the transient acclamation of a few of the less thoughtful, if we provide mainly, though only temporarily, for sight, neglecting all that is lasting or urgent, or all that is scientific or industrial. But, incontestably, a reaction of public opinion will, ere long, set in; there will be little or nothing to show for much of the expenditure of years, and a just and resentful censure will, sooner, or later, overtake us. Do you not think that even a private proprietor will view, after a time, his collection of palms, which, from year to year, increased in value, and also in ornamental grandeur, with far greater pride than his remnants of ordinary flower-beds? Will he not compare with infinitely more satisfaction the imposing forms of his inexpensively upgrown pines, from which he can harvest even the seeds, than the decayed relics of short-lived plants, which, however pleasing they may have been in their ephemeral glory, did involve probably a far greater outlay for maintenance than his lasting tree-plantations? If means will allow it, let *all* these kinds of garden treasures be simultaneously maintained, particularly as the herbaceous plants provide a sight at once. If it must be flowers mainly, then let it be largely Cactæ, Begoniæ, Aroids, Scitamineæ, all yielding flowers in the true sense of the word, for glass accommodation; and let it be the hardy, diversified plants already named in the earlier part of the lecture, which, while they are as gorgeous as any, are not ephemeral, increase in value, convey a vast amount of instruction, and lead horticulture to a higher flight.

Reverting to the noble taste of scenic group-planting, let us acknowledge it as one capable of being de-

veloped into the most picturesque magnificence, into the most grateful yield, into the most bloomy features, and, above all, into the most extensive instructiveness. Many horticulturists of eminence have shown already that, for impressive groups of plants, even in colder countries, we can dispense with subtropic forms, although, for half the year, they may still more embellish the vivid and graphic effect by bringing Tree-ferns, Palms, Yuccas, Melianthus, Bamboos, Agaves, Fourcroyas, Cycadeæ, Papyrus, tall Gah-nias, Cardylines, Cannas, Richardia, Acanthus, and the great Mexican Composites (Ferdinanda and Montagnea), and other spacious or conspicuous, and not absolutely tender plants, from conservatories, there to the open ground, with a view of enhancing the effects of such groups as may permanently be constituted by the hardy Pines, Ailanthus, Gynierium, Heracleum, Ferula, Donax, and even ordinary Artichokes and Helianthus; or the sown Ricinus, Sorghum, and Maize; or the nobler species of Rheum, Polygonum, Gunnera, or the tall Kamtchatka Angelica, all available, even in colder zones, for unprotected garden-spots.

But what shall I say of our operations here and our facilities in this respect, when the larger share of Middle European conservatory plants, from a Norfolk Island Pine to an infinite number of other plants, can be trusted out by us at once under a genial sky into the open air? How would such facilities be turned to account by eminent horticulturists of scientific knowledge and refined taste if in Middle Europe the climate allowed of it! In this respect a botanic garden can fulfill also here its duty, by introducing the nobler

forms of plants, and by educating the community to higher horticultural conceptions. You need not exclude the Rose, which we all appreciate as the queen of flowers; you need not banish anything else that is brilliant or gay or odorous, from Bulbs and Carnations to Petunias, Pelargoniums, or Dahlias, or any other favorite flower; but let us allow also for the higher decorative and utilitarian work of horticulture a fair scope. Let us study to embrace all that is attractive in any form, whether native or foreign, into one grand whole of magnificence, without singling out a few transitory plants for almost exclusive culture, and without sacrificing to a monotony which may become finally comparable to the Tulip monomania of a darker age, all loftier cultural interest, all that in this direction is elevated and great.

So vast are the treasures which floral plenty is shedding out before us, and so abundant and diversified are the gifts which from all zones are poured into the rich gardens of the centres of commerce, such as the British metropolis, that it would be a wise measure to endow a state garden like ours so far as to secure and to retain exclusively the talent and industry of a professional horticulturist for selecting in London for us, to watch the arrival of every new plant of importance, to transmit it under vigilant care, and to conduct our interchanges there and from thence on a vastly-extended scale. The amateur cultivators and the traders in plants, as also the administrators of public estates, are alike interested in such a measure, so long as it is not with the object of monopolizing with selfish views of local aggrandizement the riches thus acquired, and so long as it remains our aim to

turn these acquisitions to an enlightened account for whole communities.

It is unquestionably of importance to provide in any scientific garden, from time to time, accurate catalogues of the contents, quite as much as an inventory as to guide information and to regulate interchanges. But this is a work of such magnitude and constantly recurrent additional labor that even the grand establishment of Kew has shrunk from the task of issuing an index of all its plants since a long series of years. Not only the difficulty is encountered to identify the plants with specific accuracy, for which purpose they must be examined while in flower and fruit; but, moreover, such catalogues become almost instantly incomplete or altered, partly because annuals are a very uncertain possession, partly because we cannot imitate all the conditions under which so many plants of the alps, the moors, the heaths, the saline steppes, or the tropical jungles, are naturally thriving; hence a number of species, capricious in their mode of growth, are apt to perish in culture, however much care may be bestowed on them. Then, again, daily new access is gained in any great horticultural collection, while in the process of discovery some changes will continually occur in the nomenclature, until all plants of the globe shall have been fully collected and exhaustively studied. Under these circumstances of adversity I raised the question among leading directorial colleagues in Europe, whether, by united efforts, we could provide for the publication of an universal catalogue in annual editions, or at a regular interval of a few years. It appeared to me that, just as all navigators possess one nautical almanac, prepared

for them annually, so all horticultural establishments, those formed for trading purposes included, should enjoy the universal use of the best index which at the time can be compiled. From such standard list local catalogues could be reissued whenever and wherever necessary, while each institution may irrespectively maintain its standard copy complete for reference to the latest day.

I revert once more to the forming of test plantations as prominent among the obligations of a scientific garden. What, for instance, can be more interesting than a collection of fiber-plants, kept together in cultivation, to watch their respective endurance to climate, their rate of growth, their required nourishment, their proportion of yield, or to ascertain the strength of their products, the adaptability of the latter for various textile fabrics, their mercantile value and commercial demand?

The subject of fibers is one so large and so momentous that we might discuss it some evening specially in this hall.* A good many kinds of fiber-plants were grown experimentally under my direction, and subjected to various tests, recorded in the documents which emanated from the successive great exhibitions. Some of the results of my experiments on strength were given in the descriptive catalogue of Victorian sendings to the Sydney Exhibition of last year. But such tests must be continued or extended. I should, therefore, like to have here under access many of the numerous fiber-plants which are not yet even known beyond their native countries. The ad-

* In an index published by the Commercial-Industrial Museum of the Maison de Mello, near Ghent, the scientific names of 550 kinds of plants, yielding textile fiber, are given.

administrator of the Botanic Garden of Calcutta, in his official report (of April of this year), alludes to no less than fourteen new fiber-plants, all allied to the Grass-cloth, from Upper India alone. He thoughtfully observes: "It is, however, not the excellence in fiber that is necessary to recommend a fibrous plant as economically valuable. The principal value of Jute (*Corchorus olitarius* and *C. capsularis*) is that it can be easily prepared," as it must always be our endeavor to liberate the fiber by mechanical means, but not by chemicals or heat, from the adherent other tissues. Mr. Clarke mentions as the most promising of these new fibers that from *Villeburnia integrifolia*, a small tree from Khasia, which, with some of the other recommended fiber plants, will probably prove hardy here. He regards the *Villeburnia* as the strongest of all the Sikkim sorts, it being used there for bow-strings. In its whiteness and its fineness of texture it seems to surpass even Rhea. This fiber can be more easily cleaned than any of the others tried on this occasion, and the bush yielding it is thought to grow like Osiers. *Maoutia puya* seems the second-best in value; it is marvellously strong, and provides the Lepchas with the principal material for their native cloth. Again, from *Debregeasia velutina* many of the Assam tribes obtain their cloth.

Of the Jute fiber there were imported from India, in one single year, into England no less than 60,000 tons. The United States of America imported also about 50,000 tons in a year, there realizing £60 and more per ton, the importation in 1865 having been 91,549,800 lbs. Regarding fibers, we can learn here, by test culture through the year, during which months

the best flax crops can be obtained, what varieties of cotton can yet be cultivated to advantage in our soils and in our latitudes, cotton culture in North America terminating with the thirty-eighth degree, north. In short, there ought to be, in a scientific garden, representative plants of any important fiber hitherto drawn into industrial use. So it should be with important starch - plants, dye - plants, oil - plants, fodder - plants ; so it should be with any species adopted in medicine. Remember, only, the pretty Lupin plants, of which about one hundred different species are known ; how decorative are they all, how valuable, and so recognized since antiquity as fodder - herbs and for green manure ; how little comparison has also yet been instituted between the value of their species of the Andes, of British Columbia, of the Mediterranean regions or California. There are various kinds of Arrowroot - plants, different in their degree of hardiness ; there are oil - plants, which ripen a crop in three months, such as the Ramtil or Guizotia. All these deserve to be tested, and to be kept prominently before the eyes of our colonists.

Manures in their varied constitution and application require also experimental tests. Diseases of plants, in their increasing multiplicity, need to be carefully traced and elucidated, for which purpose the means of a well-sustained botanic garden ought to be available with legitimacy. Be it so far enough. But there is also something inexpressibly charming and recreatively instructive in viewing a very large assemblage of plants from all the different parts of the globe, scientifically traced to their names and origin.

But while devoting our energies and resources to

the primary objects of scenery, we need not disdain those ornamentation-works which serve to embellish still more a stately structure. We can build grottos, if our means admit of the conveyance of rocks from the distance. We can raise islands, and convert swamps into lakes, whenever the resources of a young establishment are no longer taxed with still more important obligations. We can have fountains playing in all directions, whenever our botanic garden can participate in that supply and pressure of our great waterworks which is allotted to other suburban parks. We can raise statues also, to glorify monumentally what is noble and great. We can draw banded flowers through smooth and verdant lawns with the utmost gaiety. But while attempting all this, we should never lose sight of the still higher objects for which a botanic institution is founded; otherwise, while trifling away slender means on perhaps even trivialities, we have failed to afford our early guidance to lasting prosperity or progressive and enduring advancements; and yet the accomplishment of this alone is an herculean task.

Rest assured, a garden so conducted as to fulfill its true destination will never fail to provide in large measure the purest of enjoyments and the amplest of comfort also.

The sufferer, who may watch the varied autumnal tints, will he be less cognizant in a garden of science how frailness finally prevails in all organic structure? Or when contemplating the forms of plants arranged by the rules of knowledge, will he feel less influenced to seek consolation from them? For, surrounded by the yet expressive and imposing sceneries, he may

trace, here above all, how life, embodied in endless forms, is passing through its allotted worldly stages, finally only to perish ; and so he must also learn to resign himself, with all else that is mortal, to a higher will.

“ Though wrapt in clouds, yet still and still
 The steadfast sun th’ empyrean sways ;
 There still prevails a holy will—
 ’Tis not blind chance the world obeys.
 The eye eternal, pure and clear,
 Regards and holds all beings dear.
 For thee, too, will the Father care,
 Whose faith and soul in Him confide,
 And though the last of days it were,
 He calls thee early to His side ;
 His eye eternal, pure and clear,
 Thee, too, regards and holds thee dear.”

GLADSTONE, FROM KIND.

Though the true destiny of a botanic garden should be maintained then with some rigor, be it far from us to withdraw those sources of pure pleasure which scientific refinement offers there to a still higher degree. Indeed, if ever we attempted to restrict an institution of this kind to absolutely utilitarian purposes, we assuredly would find the separation or exclusion of simple means of enjoyment a total impossibility. The avenues, formed of timber-trees, as forest representatives from wide distances, will afford to the strolling visitor no less of cool umbrageous expanse than if raised for his recreation only. The coloring changes of the vegetation throughout the seasons, or the varied periodic hues of foliage and blossoms, are assuredly not diminished in their impressiveness because the perhaps tyrannic sway of fashionable predilections, or of tastes subject to endless dispute, are left unbey-
 ed in the exercise of the free judgment of science. When thus in youthful freshness the Spring unfolds

the tender leaves and discloses buds innumerable, then it awakens also here the earliest hopes of the rosy youth, or renews the smiles and faith of depressed spirits. And while all nature around rejoices in hopefulness, the swift arrows of Eros are sent also unerringly from yonder close green of dense retreats, whether created for stern science or idyllic enchantment only. Those who listen in affection from fragrant bowers to the warblers of the air will not discern whether yonder groves were intended to serve mere scientific grouping or purposely formed to arouse some of the sublimest of sentiments. The soul, sunk in mournful sadness, will also find yet some consolation in a garden of knowledge, and will feel how the power of a Divine Providence pervades every leaf and flower; or the mind susceptible to the religious teaching of nature will there also recognize how the apparently lifeless root or grain sprouts under the Spring rays again with hopeful vitality from the cold darkness beneath—a symbol of an imperishable existence and of an eternity beyond this world.

“ When Spring's fair children pass away,

When in the north wind's icy air

The leaves and flowers alike decay,

And leave the rivelled branches bare ;

Then from Vertumnus' lavish horn

I take life's seed to strew below,

And bid the gold, that germs the corn,

An offering to the Styx to go.

But when the hours in measure'd dance

The happy smile of Spring restore,

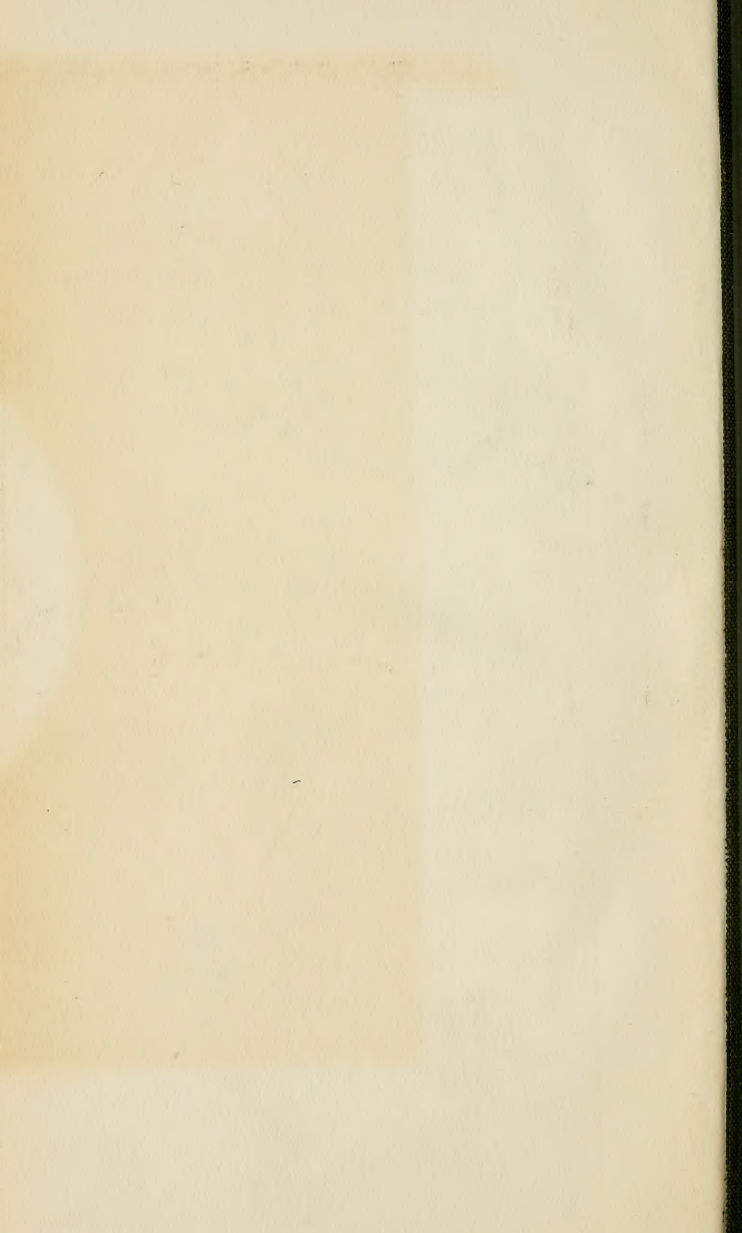
Rife in the sunny golden glance

The buried dead revive once more.”

BULWER LYTTON, FROM SCHILLER.







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