Art. XIII.—*On a General Introduction of Useful Plants into Victoria.* By Dr. Ferd. Mueller.

[Read before the Institute, 30th September, 1857.]

In responding on this occasion to numerous inquiries, I wish to draw attention to some of the most useful plants deserving either introduction into this country or a wider diffusion throughout our territory.

But I cannot hope to do within the limits of these pages justice to a subject so important and hitherto so scantily regarded, but rather desire to excite the co-operation of abler men, and the interest of the community for this purpose.

During the first periods of colonisation, the immigrants are but rarely enabled to direct their labours beyond immediate wants; and in a colony like ours, where the multitude of inhabitants were engaged in occupations foreign to husbandry, it encountered at least in some of its branches double embarassment.

But since now a large proportion of our population is returning gradually from a migratory life to the firm abodes of settled communities, the time has arrived, when our thoughts should be directed, not only to the means of our present, but also of our future prosperity. We ought to be encouraged in these views, particularly in regard to tillage, when, considering the extensive fertility of this colony, not less than when reflecting on the great advantages of our climate, which neither exposes us to the enervating influences of a most tropical heat, nor to the inclemency of the severe winters of higher latitudes.

Thus rarely favoured, we possess the means of appropriating to our colony, not only all the plants of the warm temperate, but also many of the colder and even some of the equinoctial.

When, however, pointing to the possibility of cultivating in this country, the products of so different zones, it remains to be remembered, that not all tracts of the colony are sharing equally and simultaneously this advantage, but on the contrary many of its portions are destined for a distinct vegetation.

It must suffice to describe on this occasion the climatical conditions of the colony quite superficially, but henceforth we will be better guided in our tillage operations, by inquiries into the local peculiarities of our climate, commenced by Mr. Smyth with so much zeal and ability.

In the northern parts of the colony, from the borders of the

Alps to the western desert we experience, as may expected, a drier and warmer temperature, many tracts of it being highly adapted for the growth of vine, and probably also of Tobacco, Orange, Olive.

In the southern portion of the colony, under a cooler and a moister air, we are invited, particularly in the coast vicinity, to the culture of the field-plants of Great Britain.

In the south-eastern part of our territory the prototypes of a tropical vegetation become of such frequent occurrence, that probably at a later period, when labour is to be obtained at a more equal rate with that of other countries, and (as Mr. Savage ingeniously pointed out), under the aid of machinery, these tracts of land may furnish, if not for export, at least for local consumption, some of the products of less tender plant now obtained from Indian plantations.

Such supposition may appear hazardous, when we reflect on the far southern extra tropical position of our colony ; but it is evident, that the isothermal lines are bending at our eastern frontiers southward to a degree quite unusual, as indicated by the occurrence of palm-trees of enormous size (Livistona Australis), in the parallel of Melbourne, accompanied by manifold members of a tropical flora, which in vain would be searched for in our immediate vicinity.

I venture to ascribe the serenity of the climate of Eastern Gipps Land, already alluded to in an official report on my travels, to a combined cause—namely, to the shelter, which the high mountain-chains of Van Diemen's Land afford to our opposite coast against the cold and antarctic breezes, and secondly, to an increase of heat or a mitigation of the winter temperature, resulting either directly from the southern current of the Pacific Ocean, along the coast of New South Wales, or from the indirect influence which so vast an expanse of water in ample contact with a wide tropical sea must exercise upon the coast tracts. The country referred to is, however, not directly available ; dense forests and extensive morasses form obstacles at present even to a traveller. But with better access to it hereafter, its great humidity, together with much facility for irrigation, will render it doubtless eminently adapted for the growth of rice and other culture plants of sub-tropical countries ; rice being grown under the same isothermal line in Carolina and some parts of South Europe. If the Breadfruit (Artocarpus incisa) which is cultivated a little beyond the tropics in South America, adapts itself to our climate, it will be at these localities.

Two other tracts of country, essentially different from the former ones, are of so great an extent, as to attract our notice on this occasion, one being the north-western desert, the other our subalpine plains and gullies.

Although, probably by their cultivation little is to be achieved of importance, yet a boon may be conferred upon these wildernesses, if we endeavoured to naturalise there apt plants of utility. Thus, from the distribution of the date, which in some of the arid parts of Egypt, Persia and Arabia, forms one of the principle means of subsistance to the population, we might at once benefit from the oases of the Australian deserts. My attention was directed by Dr. Greeves, who always evinces so much interest for the development of this country's resources, to the following passage in Burton's el Medinah (*Vol. II. p.* 203), in regard to the successful cultivation of this palm :—"One of the reasons of the excellence of the Medinah Dates, is the quantity of water they obtain ; each garden or field has its well, and even in the hottest weather the Persian well floods the palms every third day. It has been observed that the Date Tree lives in barren and dry spots, but it loves the beds of streams and places where moisture is procurable. The Date-palms scattered over the other places of Medinah plains, and depending solely on rain-water produce less fruit, and that of inferior quality."

The Doum-palm (Typhaene thebaica), which might be consociated with the Date, yields to the inhabitants of the territories adjacent to the Red Sea, also an edible fruit, and received from the taste of its rind the vernacular name Gingerbread-tree. Its resin is not without utility, and called the Egyptian Bdellium.

One of the Lotus plants of the ancients (Zizyphus Lotus, which occurs on the edges of the African desert, might likewise be tried for cultivation on our barren north-western plains for the sake of its excellent berries, whilst another desert plant, the Argan-tree (Argania Sideroxylon), from Morocco, has already been introduced through the liberality of her Majesty's Home Government into Australia ; and it is much to be regretted, that this plant, which once might become of some importance to the Murray runs, seems to be of such a tardy growth.

Not less is the vegetation of the subalpine plains capable of improvement. Many of the fruit-shrubs, restricted to the moors, heaths, and forests of the colder zones, or to the high mountain-regions of warmer countries, might there be reared to advantage.

It is, perhaps, not so easy to obtain for this purpose seeds of the various fruit-bushes of the arctic or antarctic countries, or from the Himalayan mountains or the Cordilleras ; but the settlers, occupying the pastures of the Australian Alps during the summer season, might secure for introduction and diffuse over our higher mountains many of the wild fruits, which we enjoyed in our native countries, such as the northern brambles, the Whortleberries including Bilberries (Vaccinium myrtillus), the Bleaberry (Vaccinium uliginosum), the Cranberries (Vaccinium Oxycoccus) and similar North American species, such as Vaccinium tenellum and V. macrocarpum.

But returning to matters of more immediate advantage, we might at least in the warmer parts of the colony, with same prospect of success, experiment on the cultivation of the mountain Rice, which neither requires irrigation nor such a degree of heat as requisite for the common rice. Amongst grains I may also briefly allude to the Chinese Sugar-grass (Holcus saccharatus), of which the Caffir variety has been lately distributed throughout the country by Mr. Archer's assiduity, under a desire of adding to the vegetable treasures of the colony. This plant can only be regarded for the present as a prolific fodder-grass, but the time is, perhaps, not distant, when we will profit from any experiments instituted on its yield of sugar, and from ascertaining how its saccharine produce is dependent on climate and soil. The Indian millet (Holcus Sorghum), which is closely allied to the Sugar-grass, is, according to the oldest historical documents of the Chinese, if not the most antique, at least the first extensively used culture-grain of that Empire. The Sorghum must indeed have been praised in the early ages of China, when weight and measures of that country were framed by the standard of millet grains. Besides the many annual varities of this grass, an allied species with perennial root, the Haleppo Holcus and the saccharine Pampas Gynerium recommend themselves to our notice. Amongst numerous fodder-herbs deserves the Italian Clover (Trifolium incarnatum) prominently to be adopted at our farms, and no doubt, by the dissemination of perennial and nutritious grasses, for instance, the European Rye-grass (Lolium perenne), the Timothy-grass (Phleum pratense), the Dogtails-grass (Cynosurus cristatus), and the common English Meadow-grass (Festuca pratensis), our pastures could be greatly enriched. Highly spoken of are likewise two Abyssinean cereal grasses, (Eleusine Tocussa and Poa Abyssinica,) and also of the spurious Canada Rice (Zizania aquatica).

It seems unlikely that the Tea-plant ever will advance to commercial value in this country, considering the amount of manual labour requisite for the preparation of its leaves, a process at present not to be achieved sufficently lucrative beyond its native country or other densely-populated States, such as the North-Western Provinces of India. It is, however, not quite improbable, that the plant would be once an acquisition to the settlers far in the interior, for obtaining independently their own supply of tea, perhaps not so much to save its transit, but rather to avoid its uncertainty.

The plant ranks fully as an ornamental bush, and affords its first harvest at the third year of growth. It may be multiplied by seed cuttings or layers, and succeeds best in a loamy soil, but according to other writers, also in a slight stony soil. The introduction of Sugar-cane was lately recommended to the colonists. I will not deny that it might be grown here, but it remains questionable whether we can grow it to advantage, except perhaps on our south-eastern frontiers, and on a few other favourable spots.

The lowest mean temperature ascertained by Humboldt, as requisite for its growth (64° F.), exceeds yet by 5 or 6 degrees the medium heat hitherto fixed for Port Phillip, whilst a temperature from 70—77° is stated to be necessary for its profitable cultivation. The very fact, that North European Cerealia are grown advantageously in Victoria, seems to preclude the possibility of a lucrative culture of Sugar-cane in this country.

Adverting to another and not less important part of our subject, the introduction on a larger scale of ornamental and useful trees, we find a field equally fertile and extensive open for our operations. Amongst the endless number of forest-trees, which we should desire to call henceforth our own, the oaks are entitled prominently to our consideration.

According to a celebrated Mexican traveller, the late Prof. Liebmann, of Copenhagen,* more than 250 species of Oaks, chiefly from the northern hemisphere, have been discovered, and he points to the remarkable circumstance of their absence in Australia and extra-tropical South America, notwithstanding the occurrence of beeches in these parts of the world, with which they are often consociated in the north.

The Sunda Islands possess 37 species of oaks, Japan 20, India 21, South Europe 14, but a much larger number than this aggregate inhabits North and Central America; of these

* America's Ege-vegetation (Copenhagen, 1851), Wallich in Hooker's Kew Miscellany IV. 321.

80 alone belong to Mexico, all without exception distinct from those of the eastern hemisphere.

Unlike our home oaks, most of these are evergreen, ruled by that law of nature, which imparts to the forests of the winterless zones an eternal verdure. How great an acquisition would these trees be to this country !

Even the oaks of tropical America and of India, will probably endure our climate, if reared on moist and sheltered localities, most of them being restricted to elevated tracts of the country. But these oaks are not alone for their handsome forms and (what we are missing so much in Australia) for their shade deserving admiration ; but also we may in choosing from such a host of species unite beauty with utility.

Esculent fruits are produced by some of the Mediterranean Oaks (Quercus Ilex, Q. Ballota, Q. esculenta.)

An other species (Q. Hindsii), of Upper California, furnishes according to Colonel Fremont's narrative the principle vegetable winter food to the Indians.

The American Oak Chesnut (Quercus Prinos) yield acorns comparatively of large size and also edible, but the leaves of the tree are deciduous. The fruits of any of the species form a staple of food for various animals.

The foliage of the North American Quercus coccinea and Quercus rubra assume a magnificent hue of red in autumn. It may guide in the cultivation of the American Oak, that according to Professor Liebmann's observations a heavy ferruginous clay, free of limestone, prevails in their forests.

Of the Mexican species probably those wooly leaved kinds from higher mountain regions (Quercus spicata, Q. reticulata, Q. chrysophylla, Q. pulchella, &c.) are best calculated for this country.

We may farther recommend the Willow Oak (Q. Phellos), the Live-Oak (Q. virens), and the Grey Oak (Q. cinerea), from North America. Quercus Skinneri is remarkable for its large acorns, measuring nearly six inches in circumferences. Major General Macarthur, with the same foresight, which he displayed here in lining some of our public roads with Blue-Gumtrees (Eucalyptus globulus) introduced the kork oak many years ago into New South Wales, where bearing now already fruit it may afford the means of raising extensive korktree plantations. The outerbark, which forms the kork, is removed from the stem according to circumstances between every four and ten years. This operation commences after about fifteen years, the tree attaining an age of at least one century.

Equal to the Oaks, if not superior to them in importance, are the pines. In whatever view we regard them, no other trees have greater claims on our attention. Quick growth, graceful forms, evergreen foliage, utility of their timber and value of their resinous secretions are in most of them admirably united, and in some instances the produce even of esculent seeds adds to their importance.

To the last category belong the beautiful Japanese Ginko (Salisburia adiantifolia), Pinus longifolia from Nepaul, Pinus Cembra from Siberia, Pinus Lambertiana, Pinus edulis and Pinus Fremontiana from North West America, and likewise the European Stone pine (Pinus pinea). The latter, which abounds in Italy is particularly recommendable in our climate. Edible kernels are likewise produced by the Moreton Bay and the Chili Araucaria (Araucaria Bidwilli and A. imbricata). The former (known as the Banya Banya tree) attains not rarely in the mountains of subtropical eastern Australia, a height of 150 feet, and must be counted with all its congeners to be the most gorgeous productions of the vegetable empire. All thrive well in this colony, and whoever has had an opportunity of admiring the grandeur of such forests can not sufficiently regret, that these noble trees are not more extensively planted in this country.

Some of the beautiful Himalayan Pines, such as Pinus Webbiana, Pinus Brunoniana, P. longifolia, P. Khutrow, P. Pindrow, P. Deodara, the European Silver-fir (Pinus picea), the venerable and gigantic Libanon Cedar, the turpentine-yielding Larch (Larix Europoea) well adapted for barren and exposed localities, and of quick growth, the Norway Spruce (Pinus Abies), the pendulous black Larch from North America, the Canadian Balsam Pine (Pinus balsamea), although of colder regions, the Weymouth Pine (Pinus Strobus) which attains in North America a height of 200, Pinus canadensis, called the Hamlock spruce, several of the huge Californian pines, such as Pinus Lambertiana, which is satified with the poorest soil, Pinus Douglassii, Pinus nobilis, Pinus insignis, the rapidly growing Sequoia sempervirens and Wellingtonia gigantea are deserving a place in any larger garden. The last mentioned pine is justly celebrated by Professor Lindley as the Monarch of the Californian forests, the height of one tree having been ascertained by actual measurement to be 450 feet with a proportionate diameter of stem ! I cannot conclude these remarks on the introduction of coniferous trees without alluding to the broad-leaved Chinese Pine (Cuninghamia lanceolata), to the Japan Cedar (Cryptomeria japonica),

to the splendid oriental Pinus Nordmanniana of unusual celerity of growth, to the Californian Cupressus macrocarpa, to Pinus cephalonica from Mount Enos, which greatly resembles an Araucaria, attaining a considerable height, and finally to the straight stemmed Kaurie-pines, or Dammaras, which are represented by a magnificent species on the East coast of Australia and others in New Zealand, East India and the Pacific Islands, exquisitely adapted for avenue. Taxodium distichum (the North American Swamp Cypress) is well qualified for surrounding the margins of lagoons.

Mr. Hyndman, of this city, who possesses great experience in forming public plantations, has favoured me with a list of pines practically known to him as recommendable for a general introduction, and I have gladly appended his enumeration at the end of this paper.

For further information on the different trees alluded to on this occasion, I beg to refer to the valuable and everywhere accessible works of Loudon.

In the selection of trees for avenue, evergreen kinds should, in a winterless country, like ours, receive preference to deciduous ones. New Zealand and the whole East coast of this continent abound in splendid umbrageous forest-trees, for us most easily obtainable. The Eucalypti, which are utterly wanting in New Zealand exhibit in the coast tract of Eastern Australia less of their otherwise vast prevalence in this continent, being replaced by a great variety of trees with horizontal leaves, which impart to their forests an appearance strikingly different to the effect produced by the generally pendulous foliage of the Eucalyptus. In these woods our attention would be attracted by many trees highly acceptable for shading our public promenades: for instance several arborescent species of Grevillea (G. robusta, G. Hillii, &c.), the red Cedar (Cedrela Australis), several large figtrees with leathery shining leaves, some beautiful sapindaceous, meliaceous and myrtaceous trees, and arborent species of capparis, Elaeocarpus, Alphitonia, Mappa, and other genera. The flame-tree of Illawarra (Brachychiton acerifolium) of mapple-like habit and adorned with brilliant blossoms can for the above purpose hardly be surpassed, if planted on rich soil, unless great rapidity of growth should be required. A variety of foreign Lauri might be associated with the former, such as the evergreen species from North America (Laurus Borbonia and L. Carolinensis) from the Canary Islands, (L. Canariensis, foetens and Indica,) and the Champhor-tree from Japan, and also the noble Lophostemon, Acmena, and our blackwood Acacia (A. melanoxylon). Still, as a quick growing tree, the

native Blue Gum (Eucalyptus globulus) remains hitherto unrivalled.

But in preference to an immense array of merely ornamental trees desirable for this country, we shall at this opportunity review rather some of those plants, which would enrich our orchards or our economic fields. The European and the smaller North American Chesnut-trees (Castanea vesca and pumila), the different Walnut-trees, including the Pekan-nut of North America (juglans oliviformis) and the black Walnut, and the shell bark Hickory (Carya alba) of the same country, claim, notwithstanding their deciduous foliage, our advertance. From the borders of the Mediterranean Sea should be transplanted to us the Manna Ash (Ornus rotundifolia), the Liquorice-plants (Glycyrhiza glabra and G. echinata), the Pistacia-tree, with its almond-like fruit (Pistacia vera), the Mastix-tree (Pistacia Lentiscus), and the Turpentine Pistacia (P. Terebinthus). China might provide us with the Wampee (Cookia punctata), with the Kum Quat (Citrus japonica), and with an another small fruit of the Orange-tribe (Glycosmis citrifolia, also with the eatable berries of Hovenia dulcis, some of the edible Eugenias and jambosas, particularly the Malay Apple-tree (E. Malaccensis), which in all probability will prove hardy in Victoria, further with its indigenous Quince (Cydonica Chinensis), the date-like Kaki (Diospyros kaki) yielded by a fine evergreen tree, with the Jujub, Litchi, and Logan fruit, (zizyphus jujuba, Dimocarpus, Logan et Lichi), of which, the latter two are exported to Europe, and the produce of ornamental sapindaceous trees. It remains to be ascertained, whether not of the different Custard-apples, the Peruvian Cherimoyer (Anona Cherimolia) will show itself hardy in our climate.

The Eugenia Ugni, from Peru, lately introduced to Europe, has been praised for its delicious fruit, and some of the oxotic Berberries are recommended on similar grounds. We may add yet the North American and South European Date-plum (Diospyros Virginiana and Diospyros Lotus).

How far the Mate or Paraguay tea, furnished by a kind of holly (Ilex Paraguensis) will succeed under cultivation in this country, and whether this beverage will meet with the approbation of the colonists is yet to be ascertained.

The Corob-tree (Ceratonia Siliqua), yielding an edible pod, known as St. John's Bread, forms a most eligible and useful plant for shrubberies, and the same may be said of the Strawberry-tree of South Europe (Arbutus Unedo) a lovely bush with

eatable fruits. On the island of the Lake of Killarny, it forms, according to Mr. Hyndman, as magnificent a tree as can be beheld. Its wood is much esteemed for ornamental work. The lovely Arbutus canariensis and A. Andrachne ought to obtain their place.

I fear it would be premature to recommend the cultivation of dye-plants under the present circumstances of the colony, as probably foreign markets will supply us for a long time yet with articles of dye at a less expensive rate than at which they could be produced in Australia. Still we might diffuse such plants as the Chinese Indigo (Isatis indigotica), the common Woad (Isatis tinctoria), the Saffron (Crocus sativus), the Carthamus and the Madder (Rubia tinctorum), of which the latter many years ago became introduced and cultivated by Mr. Edw. Wilson of this city.

Many of the colonists may be desirous to surround themselves with some of those plants, which, although devoid of practical importance to us, are of the greatest value to their respective native countries, such as the Varnish-tree (Elaeococca vernicia) from the seed-oil of which the Chinese Varnish is prepared, the Grass-cloth plant (Boeheria nivea), the Rice-paper plant (Panax papyrifer), the Tallow-trees (Stillingia sebifera and the Litsaea Chinesis), all from the Chinese Empire, and which, consequently will flourish without protection, at least in the warmer parts of our colony.

The general distribution of the Chinese yam, Dioscorea Batatas), which found its way recently into this country, remains desirable: the Spanish Scorzonera, the sweet potato (Convolvulus Batatas) and the Jerusalem Artichoke (Helianthus tuberosus) ought to be its companions; the leaves of the latter being even useful. The cultivation of Arum Colocasia, well-known for its edible tubers, extends now from Portugal to China, and the plant is therefore well-deserving of our notice.

Through Dr. Embling, who always evinced such a lively interest for adding to our stores of the animal and vegetable kingdoms, seeds of the Cotton-plant have been placed at my disposal. I gladly invite the colonists, chiefly those residing in the milder parts of the country, to subject the plant to a fair trial, even if it were only to establish the fact, that it endures the vicissitudes of our temperature without being impaired in its productiveness. Enterprise of future days may avail itself of the experience gained at present. Most cultivators of cotton recommend for its growth light fertile soil, of slight humidity.

Porter even observes that it may be cultivated on soil of so moderate fertility that it would often be difficult to procure from it any other harvest.*

A double interest attaches itself to the culture of the various kinds of Rhubarb, their roots being of medicinal value, and their leafstalks offering an wholesome acidulous vegetable. If cultivated for its root, dry shady mountain localities ought to be chosen. One species (Rheum nobile) lately discovered in the Indian Highlands belongs to the grandest objects of vegetation imaginable.

The Chinese esteem as potherbs—Cacalia procumbens, Amaranthus polygamus, the sweet root (Sium Sisarum), and Aralia edulis, the root of the latter also serving as salad ; and a kind of Cabbage peculiar to that country (Brassica Chinensis) remained also yet a desideratum of our gardens.

The Okro and the red Sorrel of West India (being the fruit of Hibiscus esculentus and Hibiscus Sabdariffa) are to be regarded as culinary acquisitions.

The cultivation of medicinal plants did not receive hitherto the attention which it justly deserves. It is intended to retain a portion of our Botanic Garden for the culture of those officinal herbs, of which the seeds will be acceptable to the gardens of country practitioners.

Some of the Cinchonas, or Peruvian bark trees, occur on the slopes of the Andes, under a mean temperature little exceeding that of Port Phillip, and are even ascending to an elevation of 10,000 feet, and their introduction to favourable humid spots in this colony will therefore probably not be attended with great difficulty.

South Europe and the Orient furnish in some sorts of Astragalus—the Gum Tragacanth (Astragalus Creticus, A. verus, A. gummifer). These plants should be secured, being of beauty, of utility, and of easy cultivation, the officinal Senna-Cassias of Arab, and the handsome Aloe plants of South Africa might well be associated with them.

The preparation of Arrow-root, Tobacco, and of Opium is probably reserved for later days of the colony. The Manihot, or South American farina (Jatropha Manihot), is cultivated somewhat beyond the tropics. It is, therefore, well deserving a place in our experimental gardens, particularly with the weight of a recommendation, according to which the produce of the Manihot exceeds sixfold that of wheat.

* G. R. Porter's "Tropical Agriculturist," p. 9.

Camellia Sasanqua and oleifera can be considered as the Oil trees of the Chinese. Being elegant plants, content with a climate which ripens the grape and with a meagre soil, and yielding tea, they seem to be eminently calculated for a profitable introduction.

The white Mulberry is employed in South Europe much in the manner of the British pollard elm, and is, with good right, recommended for field hedges or garden walls in the colony. Probably, in later days, the production of indigenous silk will become remunerative, and we might already act, preparatory to this branch of industry, in adopting, even regardless of its fruit, the white Mulberry for the needful enclosures of cultivated ground. The red and white Mulberry-trees produce, whilst young, generally only flowers—a circumstance which may have disheartened many in their cultivation ; but the fruitfulness of these trees increases with advancing age. The most nutritious variety for the silkworm is the Lee Mulberry (Morus intermedia). I ought finally to suggest that no efforts should be spared to acquire those gorgeous water-plants, which not only tradition, and historical monuments of the remotest antiquity, have pointed out as sacred in the dark ages of the past, and as a tribute of mythical veneration, but in which also the enlightened genius of the present age recognised the emblems of majesty.

The Nelumbo, or sacred Pythagorean Bean (Nelumbium speciosum), will be probably easily naturalised, particularly when already Sir George Stounton informs us of its occurrence in the north of China.

The equally useful and grand Nelumbium luteum of North America exists, according to Mr. Hyndman's information, even in Lake Erie, within the isothermal zone of England.

It seems that the roots, protected by the unfreezing depth of the water, retain vitality, and thus send annually forth their leaves and lovely blossoms.

The endeavours of transplanting the incomparable Waterlily, of the Amazon River, and other waters of Central America (Victoria Regia) to our lakes and lagoons may less likely be crowned with success.

Since, however, this brilliant plant has been flowering at Mauritius, no difficulty can arise in securing it, with many other tropical water plants, at least, for the warmer parts of Eastern Australia.

Far from having exhausted my material, I conclude these remarks for the present, and venture to hope that I shall not in vain appeal to those colonists who have had an opportunity of

visiting, besides Australia, other extra-European countries, to favour us with their observations on culture plants, of which every country has its own, and many yet eligible for us. Thus any friends of progress might amply enrich our fields. I did not attempt to enumerate even the principal plants which would enhance the beauty of our gardens. But, in the warmer parts of the country, the Bamboo and the Nile-papyrus ought to line the water-courses. Nor should in vain the charming Rhododendrons, the Kalmias, Liriodendrons, the palm-like Encephalarti, the magnificent Luculias, Magnolias, Photinias, and an endless number of equally beautiful shrubs solicit in our gardens for a place. Nor can I suppress a hope of seeing the fanciful varieties produced by horticulture recede before the simple grandeur of Nature itself, and seeing in the choice of foreign plants for introduction, variety and beauty combined with utility, and views adapted in our own permanent selection from the floral treasures of the world, of which a future generation will approve.

Useful and Ornamental Pines recommended by Mr. Hyndman for introduction.

Libocedrus tetragona, a beautiful tree, introduced by Mr. Lobb from the Andes of Patagonia, attains a height from eighty to a hundred feet. It grows very fast; timber good.

Cupressus torulosa.—It is said, by those who have seen it growing on the Himalayas, to rival almost the noble Deodar Cedar, in size and beauty. By Major Chadden, a very clever English botanist, who has spent a number of years in India, I have been told that its timber equals that of the Deodar.

Cupressus Uhdeana.—This species differs in appearance materially from all the other kinds of Cypress, and it grows with extraordinary rapidity. It is a beautiful tree, and a native of Mexico.

Cupressus majestica.—It has a noble habit, grows quick, and is of easy culture.

Cupressus macrocarpa (Large-fruited Californian Cypress).—This is a very beautiful species, with horizontal branches, and bright green foliage. It grows very rapid, and attains a height of 100 or 150 feet, and 9 feet in circumference. Mr. Hartweg, the introducer of this species, says, "It resembles the Cedar of Lebanon it its style of growth." The timber is good.

Chamæcyparis sphæroidea (the white Cedar of New England) is a beautiful tree, grows in swampy places, attains a height of

eighty or ninety feet. The timber is light, soft, fine grained, and easily worked ; it resists the alternation of dryness and moisture longer than the wood of any other tree growing in America.

Taxodium distichum (Bald Cypress).—This is a beautiful tree. In its native country (Florida) it grows to about 150 feet high, and from 90 to 100 feet in circumference ; the timber is good, but soft. There is a specimen of this in Chatsworth 80 feet high.

Pinus mitis.—This tree furnishes the Yellow Pine of Commerce. It has long slender leaves and large cones : it is a very handsome tree. The young shoots are covered with a velvet-coloured bloom. It grows on the poorest soils of America ; grows quick.

Pinus Fremontiana.—This is a handsome dwarf-growing Pine, and is well worth cultivation, as its seeds are very nutritious and pleasant flavoured, having the taste of Almonds, and the cones are produced in great abundance. It grows on the Sierra Nevada, or great Californian mountains.

Pinus ponderosa, a very remarkable species, and very ornamental. The buds are large, pointed, and free from resin. The branches are horizontal at first, but generally drooping at the extremity.

Pinus Benthamiana, a noble species. It sometimes attains the height of 200 feet, with a stem 28 feet in circumference ; it grows very quick, and the timber is very valuable. It grows on the mountains of Santa Cruz in California.

Pinus Australis (Syn. P. palustris) has leaves as long as P. longifolia, but of a beautiful brilliant green ; and it has the advantage, not only of being a very ornamental tree, but of producing better wood than almost any other kinds of North American Pine, the wood being durable, fine-grained, and susceptible of a very high polish. It has also the recommendation of growing well near the sea, where there is only a thin stratum of mould covering the sand. Its wood is that known in commerce as the red Pine.

Pinus insignis.—This Pine has been well named, its general appearance being indeed remarkable, and quite different from that of every other species yet introduced. It is a tree of great beauty, with leaves of a rich grass green colour, and grows with great rapidity ; the wood also is good.

Pinus radiata.—This species is very nearly allied to P. insignis, but the cones are nearly three times as large. It was found growing almost close to the sea beach in California, attaining a height of 100 feet, with a straight stem feathered

down to the ground with branches. It is said to afford excellent timber, which is very tough, and admirably adapted for boat-building : it is also well adapted for planting near the sea coast. The leaves are of a dark green, and very slender.

P. macrocarpa.—The leaves of this species are from ten to fourteen inches long. The trees are of tapering form and regular growth, attaining a height of 150 feet ; the timber is good. The cones are furnished with hooks three or four inches in length, and very strong. The leaves are of a beautiful glaucous hue.

Pinus Sabiniana.—Is very like P. macrocarpa, but the cones are not hooked ; they are prickly, hence the names of Prickly-coned Pine and great hooked Pine. Both are from California.

P. Montezumae, a very handsome tall tree, with rather long leaves and large cones. The timber is said to be good : it grows to sixty feet high. It is from Mexico, near Ajusca.

Pinus macrophylla, remarkable for its very long leaves, which are nearly twenty inches long ; the timber is good, but the plant is rather rare yet. It is a native of Mexico, on the Ocotilla.

Pinus Grenvillea.—This Pine is also remarkable for its long leaves and large cones, which are sometimes sixteen inches long. The natives call it " Ocote macho, or the Male Pine," on account of its robust habit of growth and noble appearance. It grows from 80 to 100 feet high ; the timber is said to be good. It grows on the Terra de San Juan (or Saddle Mountain), in Mexico.

P. cembra, a beautiful pine. It grows rapidly, with a straight trunk, and smooth bark. The wood is soft, but has very fine grain, and it is very much used by the shepherds of Switzerland and the Tyrol for carving those curious little figures of men and animals which are known all over Europe. The seeds produce oil abundantly, and the shells of the kernels yield a fine red colour.

Pinus excelsa.—This is an Indian pine, which the natives call the King of the Fir Tribe. It grows to 100 feet high, and is remarkable for its drooping branches, from which peculiarity it has been called by travellers in the Himalayas the " Weeping Pine." It yields a great quantity of turpentine, and its timber is excellent. There are very fine trees of this species in England.

Cedrus deodara.—Is found on the Himalayas, at an elevation of from 7,000 to 12,000 feet. It is decidedly the most ornamental coniferous tree ever introduced, and, from its great beauty, rapid growth, perfect hardiness, and valuable timber, it

is exceedingly well suited for being extensively planted in parks and pleasure-grounds. Dr. Falconer gives the dimensions of a fallen Deodar, which he saw on the Himalayas, as 36 feet in circumference at the base, and 130 feet in length. The same authority states that timber of the Deodar, taken from a temple, supposed to have existed at least 1000 years, was, to all appearance, as sound as when first placed there, not affording a dwelling even to a solitary insect. "The wood of the Deodar," Mr. Loudon has remarked in his *Arboratum Britannicum*, "has a remarkably fine close grain, capable of receiving a very high polish—so much so, indeed, that a table formed of the section of the section of a trunk four feet in diameter, sent by Dr. Wallich to the late Mr. Lambert, has been compared to a slab of brown agate! But, unfortunately, all the plants of this tree, grown in this colony, are from layers; and none of the coniferæ ever make good plants, unless grown from seed, except the Cypress, which may be advantageously increased by cuttings.

Araucaria imbricata is decidedly the most remarkable species of the genus. It has a very singular appearance; the trunk is quite straight; its bark is thick, and in old trees corky. The wood is also not only very strong and good, but it is full of beautiful veins, and is capable of being polished and worked with the greatest facility. The seeds, which resemble that of an almond, but is double the size, is reckoned wholesome food; when roasted they taste something like chestnuts. There are some plants of this to be seen in England 40 feet high. It grows to 150 feet in Chili.

Araucaria brasiliana is a very handsome tree, but is much more tender than A. imbricata.

Sequoia sempervirens.—The Bastard Cedar was first discovered by Mr. Menzies in 1796, and was seen growing by my late lamented friend, Dr. Coulter, about 40 years afterwards, but it was not introduced to England until 1843, when plants of it were sent to London by Dr. Fischer, of St. Petersburgh. One of the trees seen by Dr. Coulter measured 270 feet in height, and 55 feet in circumference, at 6 feet from the ground. This tree is called by the American settlers "The Giant of the Forest." The wood is beautifully red, fine, and close grained: it grows very quick.

Podocarpus chilina.—This tree is called in Chili, Maniqui. It is a beautiful tree, producing excellent timber; it grows to 50 or 60 feet high.

Torreya taxifolia is a tree from 40 to 50 feet high, which has a very disagreeable smell when burnt. The wood, though

of small dimensions, is very durable, and not liable to the attacks of insects. It is a very pretty tree. In Japan an oil is made from the kernel of the nut of T. nucifera, and used for culinary purposes. It is a very handsome tree.

Art. XIV.—*On Railway Gradients.* By William Austen Zeal, Esq., C.E., Melbourne.

[Read before the Institute, 2nd September, 1857.]

Mr. President and Gentlemen,—The discussion of a subject of so much importance to every colonist in Victoria, cannot be considered at a more opportune time than the present; and, no Institute in this province, can with greater advantage to the public express its opinion at this particular crisis, than this Society can now do.

Impressed with this idea, I have written this paper, being convinced no undertaking will have more influence on the future well-being of this great country, than the extension of Railways throughout its length and breadth. This I conceive to be a sufficient incentive for my claiming for it all the publicity so important a question demands.

Victoria, in fact the whole Australian continent, must rely upon, and find in Railways the one great means by which the interior will be rendered available for colonization. Denied the advantage of water carriage, like that possessed by all other countries, an artificial mode of intercommunication must be resorted to, and the Railroad will be called upon to undertake the united duties of Road and River; and from all former experience no better agency can be employed, no more expeditious mode of transit could here be initiated, than that offered by the Railway system.

It is well-known when Railways were first introduced in Britain, the observance of this fundamental law was rigorously enforced;—that the surface of the Rails should form as nearly as practicable a horizontal line and for a lengthened period it was deemed impossible to ascend an incline by locomotive power, except under the most favourable circumstances.

Corroborative of this fact, is an instance patent to all conversant with Railway History; viz.: the virulent opposition the English South Western Company experienced at the hands of the