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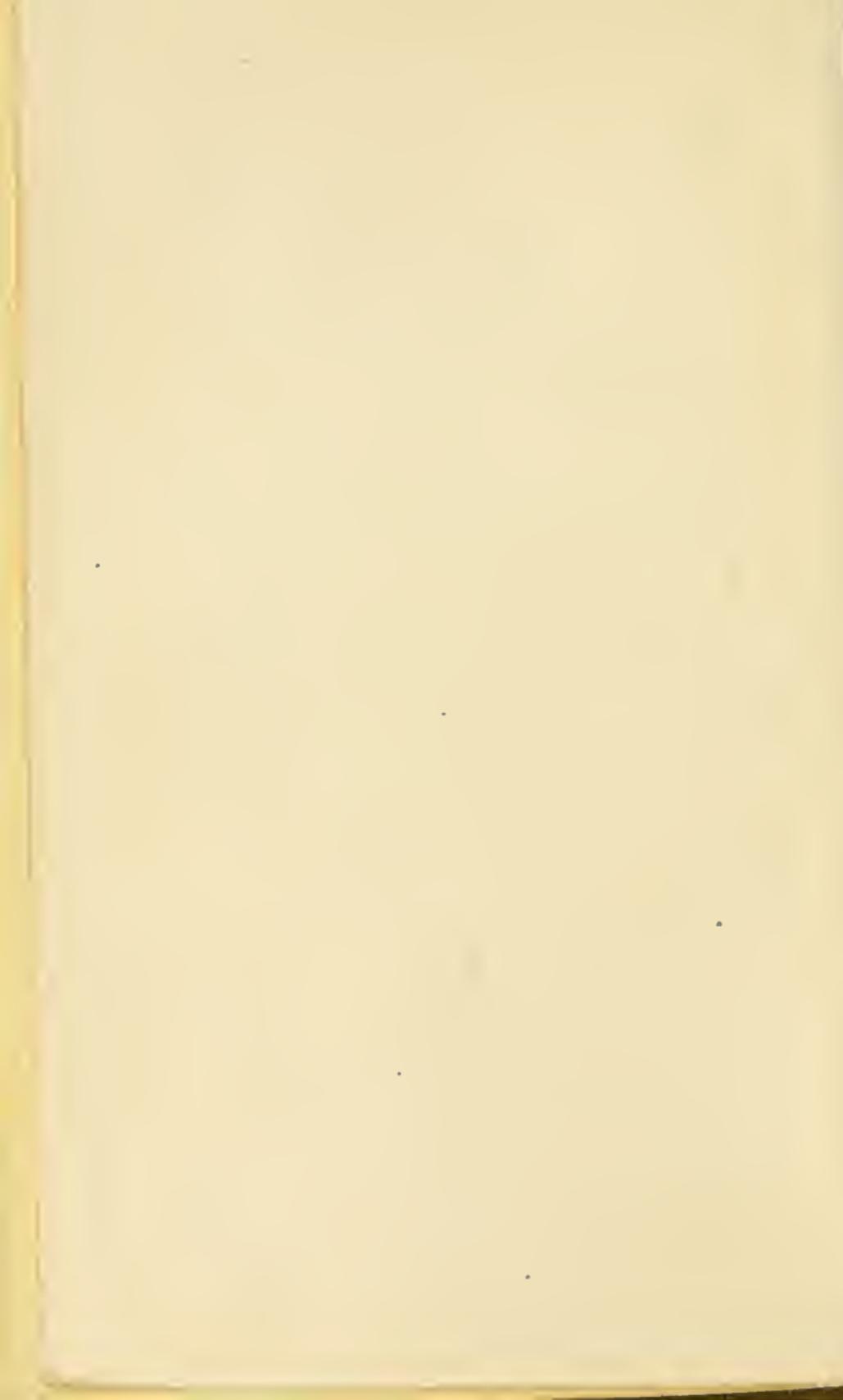
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THE PALM TRIBES

AND THEIR VARIETIES.



CHAPTER I.

INTRODUCTION—THE PHYSIOGNOMY AND PHYSIOLOGY
OF THE PALMS.

AMONG the many wonders which strike the mind of the student of nature, and which most convincingly tell of the wisdom and beneficence of an omnipotent and omnipresent Creator, a very prominent one is the vast variety observable in the productions and operations of the natural world. In the vegetable kingdom, for example, which clothes the earth with a carpet of rich verdure, and which ministers so extensively to our necessities and luxuries, it might seem at first sight that a few species comparatively would afford all that was really needed for the supply of the wants of man and beast. And yet we find that botanists have described

above ninety thousand species of plants ; while vast districts of our globe remain unexplored, and the productions of others are but little known ; so that it has been calculated by those best able to form an opinion, that at least two hundred thousand species of plants tenant the earth. To how few of these, in the present state of our knowledge, can any practical use be assigned ! and yet we know that God has made nothing in vain, and every year's discoveries reveal some fresh proof of this. Plants, which have appeared useless before, are found to play important parts in the economy of the natural world ; or properties, hitherto unknown, are detected in them, which render them valuable. Let the applications of the recently discovered gutta percha—the continual additions made from the vegetable kingdom to the resources of the healing art—and the discovery of the numerous useful products of bog-peat by Mr. Reece, serve as examples.

Although, to an ordinary observer, the vast number of species of plants might seem to present such a variety of appearance and character, as to render any attempt to classify them a hopeless task, yet it will be readily observed, that some large sections of the whole stand out with so marked and striking a family likeness,

that even the uninitiated would at sight assign them a connected standing. Such truly natural assemblages are the grasses, the heaths, the mosses, the ferns, the composite, umbelliferous and cruciform plants, the palms, and some others. We propose to take one of these families, THE PALMS, and to illustrate it in a popular manner by tracing their structure, characters, and uses.

The race of plants to which the name of "palms" has been assigned, is a tropical tribe, confined exclusively to the warmer portions of our globe. Though usually attaining the bulk of trees, and sometimes even of gigantic dimensions, they are totally unlike in appearance to those vegetable forms which usually greet our eyes, and are therefore unfamiliar in aspect to the dwellers in temperate climes; and yet their stately forms can scarcely be called strange, since they are presented as a constant accompaniment of almost every pictured oriental landscape. The tribe of palms is, also, one of the most interesting in the whole vegetable world, if we consider the majestic appearance of their towering stems, crowned by a still more gigantic foliage—the character of grandeur they impress upon the scenery of the countries they inhabit—and their immense value to

mankind, as affording food and raiment and numerous articles of economical importance.

The type of the palm tribe may be described thus. A trunk rising erect from the ground to a height varying according to the species, unbranched, leafless, except at the top, but scarred all over with the spots where leaves, now dead and gone, have formerly been attached. From the extreme summit there springs a crown of gigantic leaves, with very numerous divisions, which are either disposed like a feather, resembling enormous ostrich plumes, or else like the ribs of an expanded fan. From among this crown of leaves a bud at length pushes, which, as it opens, is perceived to be a large sheath, (something like the flower of the common arum, or "lords and ladies,") called by botanists a *spathe*, which discloses an immense mass of flowers, and these at length falling off, give birth in due time to equally huge bunches of fruit. Such are the ordinary features of a palm; but there are some exceptions. There is scarcely any tribe of plants in which some species do not present singular departures from the character of the rest, forming "aberrant species,"—transition forms between one tribe and another—connecting links, which show how nicely and wonder-

fully God has arranged the vast scale of being and life, whether animal or vegetable, so as to present a connected chain or gradation of existence, from the simplest and lowest forms up to the highest and most complex organizations. Most of the palms have unbranched (simple) stems; but the *Hyphæne thebaica*, or doum palm of Egypt, and one or two others, have regularly forked stems, thus indicating an approach to the external character of the higher order of timber trees. Others again, as the rattans, (*calami*;) are slender climbers, which hang about the trees of Asiatic forests like living ropes, and, from their siliceous cuticle, seem to have some affinity with the grasses. This would hardly be suspected if we compare the grasses of our meadows with the cocoa-nut or date palm, but it becomes more apparent when the bamboo is placed by the side of the cane.

The palms were entitled by Linnæus, “the princes of the vegetable world;” and Von Martius enthusiastically says, “The common-world atmosphere does not become these vegetable monarchs: but in those genial climes where nature seems to have fixed her court, and summons around her of flowers, and fruits, and trees, and animated beings, a galaxy of beauty,—there they tower up into the balmy air, rearing their

majestic stems highest and proudest of all. Many of them, at a distance, by reason of their long perpendicular shafts, have the appearance of columns, erected by the Divine architect, bearing up the broad arch of heaven above them, crowned with a capital of gorgeous green foliage." And Humboldt speaks of them as "the loftiest and stateliest of all vegetable forms." To these, above all other trees, the prize of beauty has always been awarded by every nation, and it was from the Asiatic palm-world, or the adjacent countries, that human civilization sent forth the first rays of its early dawn.

The aspect of the palm tribe (although there prevails a considerable "family likeness") is extremely varied; yet grandeur is their chief characteristic, whether taken individually or collectively. They differ much in height, some not exceeding a few feet, (as the dwarf palm of Spain, *Chamærops humilis*;) while others, such as the wax palm of the Andes, (*Ceroxylon*,) rear their lofty trunks to an elevation nearly, if not quite equal to that of the Monument in London, while their summits are decorated with a right regal crown of the most graceful foliage. The rattan palms (*calami*) again are thin, elegant, rope-like trees of enormous length, though their dimensions are not so apparent in consequence

of their twisting round the trunks of the taller trees, dangling in giant festoons from bough to bough, or tying together, in nooses of the most fantastic kind, trees that are considerably distant one from another, these cord-like stems being also made more graceful by the addition of a lovely foliage. Some species of calamus (*C. rudentum*, etc.) exceed five hundred feet in length; and Rumphius says that they grow even to the length of one thousand two hundred, or one thousand eight hundred feet, (from one-fifth to one-third of a mile), probably the greatest length attained by any single plant.

Very different, too, in bulk are the trunks of the palms. Sometimes they are disproportionately thick and corpulent, as in the oil palm; sometimes slender and feeble as a reed, as in *Kunthia montana*; sometimes towering to a height of one hundred or even two hundred feet, with a trunk not more than six or seven inches in diameter, as in the West Indian cabbage palm; while others, more apparently proportionate, are of considerable bulk, as well as height. Occasionally the stem is swollen in the middle, and tapers towards the top and bottom, as in the *Palma real* of Cuba. In some cases the base of the stem commences at some distance above the surface of the earth, being

supported upon an arched scaffolding of roots, one or more feet high. Humboldt mentions having seen viverras and small monkeys pass under the scaffolding formed by the roots of the *Caryota*. In some palms, the roots lie coiled round the base of the stem in a padded-like roll.

The surface of the stems of palms is as varied as their stature and bulk. Some are traversed in a curious manner by rings or spiral grooves, caused by the leaves falling off as the tree increases in age and height. The bark of some (as the *calami*) is smooth, polished, and covered with a siliceous coat; and that of others presents the strange appearance of a dense clothing of bristly hairs, especially near the summit, where they are often most remarkable. In some species, the trunk is scaly, and in others prickly, as in some South American palms, on the stems of which the thorns, which are often formidable and of huge size, are very regularly arranged in rings. Often, in their native forests, will the stately trunks of the palms appear clothed from base to summit with a matted mass of verdure and a profusion of flowers not their own; hosts of parasitic plants of those strange forms which impart so peculiar a character to tropical forests, almost hide the real character of the tree: a great orchid

will, in some unaccountable manner, get a firm seat upon their summit, and thence drop down its outlandish roots, and leaves, and marvellous flowers, in rich profusion ; or some of the wild wood creepers will clasp round them, and tie them as it were to the earth, something like to the cordage of a ship's mast. Occasionally man himself makes a similar use of them, and trains up their stems the plants he has pressed into his service. The common black pepper vine and the betel plant are thus trained up the trunk of the *Areca catechu*.

Next to the stems, the foliage of the palms claims our attention ; it is one of their most wonderful characteristics. The size of the leaves is as gigantic as their form is elegant ; ten, fifteen, or twenty feet is by no means an uncommon length for palm leaves to attain. Those of the talipat palm, which is found abundantly in the island of Ceylon, are frequently upwards of eleven feet long and sixteen feet broad, and have been used to cover the entire freight and crew of a boat, fifteen or twenty men finding a complete shelter under this colossal leaf. In the *form* of the leaves, there is much sameness. Those of the great majority of the tribe may be classed under two forms, either feathered, (*pinnate*,) that is, having a long

leaf stalk, on each side of which numerous long, narrow leaflets are disposed much in the same manner as the *laminæ*, or vanes, of a feather, or like the teeth of a double-rowed comb; or else fan-like, (*palmo-digitate*,) that is, having the leaflets all united at the base in one point, and spreading thence in every direction of a horizontal surface, like the ribs of a fan, or the extended fingers of the hand. There are some few exceptions to this rule, the most remarkable of which is *Caryota urens*, whose leaves are shaped like a wedge, or the letter v. The green of the leaves is either dark and shining, or of a silvery white on the underside, as in the slender fan-palm, (*Corypha miraguama*.) Sometimes the middle of the fan-like leaf is adorned with concentric yellow and blue stripes, in the manner of a peacock's tail, as in *Mauritia aculeata*, which Bonpland discovered in South America. It is to the close comb-like manner in which the stiff sword-shaped leaflets of some of the palms are arranged, that they owe the beautiful reflections of solar light that play over the surface of the leaves, which shine with a brilliant verdure in some, (as *Cocos*,) and with a fainter and ashy-coloured hue in the date palm. Sometimes the foliage assumes a reed-like appearance, having a thinner and more flexible

texture, and being curled at the extremity like some grasses. The direction of the leaves must also be noticed. In most palms they point upwards, curving gracefully towards the point to a greater or less degree. In some, however, they are pendant, as in *Corypha tectorum*, and in others nearly horizontal, as in the date palm. It is this upward direction of the giant leaves, says Humboldt, that, together with their lofty stems, "gives to the palms their character of high majesty. It is a character of the physiognomical beauty of the palm that its leaves are directed upwards throughout the whole period of its duration, and not only in the youth of the tree, as is the case of the date palm. The more acute the angle made by the leaves with the upper part of the stem," (that is, the nearer they approach the perpendicular,) "the greater and nobler is the form of the tree." The leaf-stalks of palms are either smooth, sharply-toothed, or serrated, or even spiny; and at the base, where they spring from the stem, they are often fringed with a strong coarse network of fibres.

In all the palms, the flower buds burst forth from the stem immediately beneath the leaves; the mode in which this takes place, however, varies in different species. The flowers

are clustered in dense masses upon a stalk, often branched, which is termed the *spadix*; and this is at first entirely inclosed in an envelope, called the *spathe*, which at length bursts, and then forms a sheath partially enwrapping them. Sometimes the sudden bursting of the spathe is accompanied with a sharp report; this phenomenon has been observed by Humboldt and Schomburgk in the American *Oreodoxa oleracea*, and has long been reported of the talipat palm of Ceylon. In some, the bunch of flowers with the spathe is perfectly erect, as in the *Corozo del sinu* of South America, of which the fruit forms a dense cluster, resembling the fruit of the pine-apple. In the talipat palm, the inflorescence rises in a pyramidal form to a height of thirty feet. In the majority of species, however, the sheaths, which in some palms are smooth, and in others rough and covered with prickles, bend downwards. The colour of the blossoms is usually yellow, and they have a remarkably faded appearance, even when they first burst from the spathe; but in some few species they are of a dazzling white, and are then distinguishable from a great distance. So vast is the number of flowers borne by some of the palms that it seems almost incredible. A single bunch of the

male flowers of the date palm contains about twelve thousand separate flowers; while another (the seje palm) has been estimated to bear above two hundred thousand in each cluster, and three times that amount on each individual plant.

The form and colour of the fruit of this tribe present more variety than is generally supposed to be the case in Europe. *Mauritia flexuosa* has egg-shaped fruits, whose smooth, brown, and scaly surface gives them the appearance of young pine cones. How great is the difference between the large triangular cocoa-nut, the strange-looking double fruit of the *coco de mar*, the hard nut of the vegetable ivory, the berry of the date, and the small stone fruit of the corozo! But of all the fruits of the palm, none can be compared for beauty with those of the pirijao of San Fernando and San Balthasar. They are oval, and of a golden colour, (one half being of a purplish red,) are mealy, without seed, two or three inches in thickness, and hang, like grapes, in rich clusters of seventy or eighty together, from the summits of their majestic palm trunks. The vast mass of fruits borne by single trees is very remarkable. The date palm commonly produces seventy to a hundred pounds of fruit, and sometimes twice

that quantity. The oil palm bears six hundred to eight hundred fruits at once; and in the palm groves at Pihiguao, single trees annually bear four hundred fruits of an apple shape. Notwithstanding that the mass of fruit yielded by single palms is so enormous, the number of individuals of most species growing wild does not appear to be very considerable, a fact which may seem strange; it is probably explainable by the frequent abortive development of the fruit, and the voracity of the enemies by whom they are assailed.

The palms belong to that class of plants known to botanists under the term Endogens. It is one of the distinguishing properties of this order that the plants comprised within it possess no true pith. The centre of the stem is soft, being composed principally of cellular tissue, with the occasional occurrence of bundles of woody fibre, which become more frequent as they depart from the centre and approach the circumference. This structure, which is peculiar to endogens, renders the trunks of such trees incapable of expansion after they have attained a certain size: for, in proportion as the bundles of woody fibre accumulate at the circumference, they render it continually denser and harder, till at length it becomes so closely

packed that a powerful blow from a sharp hatchet will often fail to cut it. This inability of expansion in the stems necessarily limits the age of endogenous trees: they die in the end of actual choking: the vessels become so densely impacted, and so obstructed by secretions, that the circulation of the sap is impeded, and the tree languishes and dies. Palms that have begun to be sickly from this cause have been restored to vigour by splitting down the trunk with an axe, which has afforded the needed means of expansion to the compressed vessels. The cells of the soft central portion of the stem are, in many palms, stored with starch, which is of great use as being a reservoir of nutriment for the growth and maturity of the plant. Starch is a very important secretion in the vegetable economy, as well as a valuable product for the service of man. It is, in fact, a kind of gum, stored up in minute bladders, as may easily be seen by a good microscope. These delicate bladders are not acted upon by cold water, but hot water instantly dissolves them, and sets free the gum, which appears to be contained in them in a semi-fluid state; the reason is thus evident why starch, when once boiled, can never be restored to its original state and appearance.

Though cold water will not act upon starch-grains, many chemical agents will, and among others sulphuric acid, which not only dissolves the little bladders, but has the remarkable property of converting their gum into sugar. Though sulphuric acid is not present in plants, there is another substance which does exist in them, possessing the same singular power, and apparently having precisely this end to fulfil; it is called *diastase*, and very minute quantities of it are sufficient to effect the change. Now mark the wonderful arrangement by which not only suitable provision is made for the support and supply of the functions of vegetable life, but at the same time stores are laid up for the service of man. The roots of the plant draw water from the soil, and perhaps some very small amount of other ingredients. It is carried by the vessels of the stem into the fine ramifications of the leaves, where it is impregnated with carbonic acid, derived from the air, through the pores, or *stomata*, which stud the under side of every leaf. In the wonderful chemical laboratory of those leaves, that carbonic acid is decomposed, the oxygen given off to the air again, and the carbon further elaborated into starch, which is deposited as the sap circulates in the cells of the cellular tissue, there to

remain until needed. When this is the case, it is acted upon by the diastase, and converted into sugar, which, dissolved in the sap, passes on to form the *parenchyma*, or substance of the leaves, the flowers, or to be stored up in the fruit. Hundreds of pounds of this article are found in the trunk of a single tree; and, under the name of sago, (for sago, arrow-root, tapioca, tous-le-mois, etc., are only different kinds of starch,) it contributes largely to supply the necessities and minister to the comforts of man. Sugar, too, as we shall see, abounds in the juice of the palms, especially when they are just coming into flower, as then there is the greatest demand on the stores of the tree for nutriment.

The flowers of the palms are composed of three petals and three calyx leaves, and the stamens vary from three to many times that number. Many of the palms are monœcious or diœcious, that is, they bear flowers, some of which contain only stamens, others bearing pistils; and where these grow on distinct plants, as in the date palm, it frequently requires some attention in order to insure their fertility. It was this circumstance chiefly that led Linnæus to the important discovery of the sexes of plants, upon which he based his system of classification.

It was found that unless the pollen could by some means be conveyed from the stamen-bearing flowers to those which contained pistils and young fruit, the latter would never ripen, but, after they had reached a small size, would invariably wither and fall off. It was evident, therefore, that the contact of the pollen was necessary for maturing the fruit. The knowledge of this fact led to a wider investigation of the subject, and it was found to apply universally. In most plants, the stamens and pistils are both in the same flower, so that when the anthers discharge their pollen, a portion is sure to fall upon the pistil; but in some the stamens and pistils are in separate flowers. If both kinds of flowers grow on the same plant it is termed *monœcious*; but if stamen-bearing or male flowers grow on one plant, and pistilliferous or female flowers on another and distinct plant, it is then termed *diœcious*. This is precisely the case with some of the palms, among which is the date palm. Insects, flitting from flower to flower, or the agency of the winds, are usual means by which pollen is conveyed from one flower to another in diœcious plants; but often there are no male palms growing within a considerable distance of the fruit-bearing ones, and the Arabs have, there-

fore, been long in the habit of obtaining clusters of male flowers from the places where they grow, and hanging them over the spathes of female blossoms to insure the ripening of the dates. Stores of pollen are often laid up from year to year for this purpose, and so great is the value of the date palm and the importance of the crop, upon which many oriental tribes depend almost entirely for subsistence, that one of the severest injuries a hostile force can commit in an invaded territory is to cut down all the male palms.

The structure of the fruit is various. It is considered by botanists to consist in its regular form of three cells, but two of these are sometimes obsolete, and the fruit then appears one-celled. The structure of the cocoa-nut is very curious. In the germen, the fruit of the cocoa-nut is three-seeded, and has three distinct embryos, one of which is opposite to each of the spots which in the mature nut are marked by three dark scars near one end. Two of these embryos, however, constantly prove abortive; and the scars, which are the holes through which these embryos would have protruded had they been developed, become as hard as the rest of the shell; while the scar opposite to the only germ which has fulfilled its destined purpose is so

soft as to be easily pierced with a pin. The use of this curious provision is to allow a passage through the shell of the nut for the germinating embryo, which, without this wise contrivance, would be unable to pierce the hard case in which it is confined.

It would take up far too much room, as well as be foreign to our purpose, to enter into details respecting the *general* anatomy and physiology of the palms. The points now noticed are those of the greatest interest, and of most importance to the due illustration of the facts which we shall have to state respecting the several species. Those who desire further information on this topic will find it popularly and ably treated in the "Popular Cyclopædia of Natural Science," the part on Vegetable Physiology, by Dr. Carpenter; and with respect to the palms, there is a most elaborate and scientific memoir on their minute anatomy by Dr. Mohl, in the gorgeous work of Martius, "*Genera et Species Palmarum*," etc., although the difficulty of gaining access to the work, and its being written in Latin, will debar most from consulting it.

CHAPTER II.

THE GEOGRAPHICAL DISTRIBUTION OF THE PALMS.

IN a former volume of this series, ("The Geography of Plants,") many facts were adduced illustrative of the distribution of the various classes of plants over the face of the earth ; and the equinoctial zone, comprising an extent of fifteen degrees on either side of the equator, and corresponding to an altitude of 1,900 feet above the level of the sea at the equator, was there described as the "region of palms and bananas." But though this section of the globe is pre-eminently the home of the magnificent order of plants now under consideration, we must not regard them as confined to it. The true palm climate, according to Humboldt, has a mean annual temperature of 78° to $81\frac{1}{2}^{\circ}$ Fahr., which embraces all the countries included within the tropics of Cancer and Capricorn, or 23° on either side of the equator. Some few species, however, extend the geo-

graphical limits of the palms beyond this. In Europe, the date palm and the dwarf coast palm (*Chamærops humilis*) are found in Spain and Italy as far as 44° north latitude, as about Genoa and in Valencia, where there are whole forests of the former. Some date palms at Rome have stood a cold of $2\frac{1}{2}^{\circ}$ below the freezing point. In Asia, the date palm reaches its northern limit at Smyrna, in latitude $38^{\circ} 25'$. In the centre of that continent, the Himalayas seem to be the limit, but the botany of Thibet is all but unknown. *Rhaphis flabelliformis* and *Chamærops excelsa* occur in Japan, between 30° and 40° north latitude. In America, *Chamærops palmetto* has the most northerly range of the species of this family, and it does not advance beyond 34° .

In the southern hemisphere, Mr. R. Brown found that palms, of which there are however but few (six or seven) species, advance as far as 34° south latitude in Australia, while one (*Areca sapida*) was seen by sir Joseph Banks in New Zealand in latitude 38° . In Africa, which is poor in palms, only one species, *Hyphæne coriacea*, advances as far as Port Natal, 30° south latitude. The continent of America presents almost the same limits. *Jubæa spectabilis*, the "Coco de Chili," the only palm indigenous to

Chili, advances on the west side of the Andes to 34° . On the east side of that chain, in the Pampas of Buenos Ayres and La Plata, palms extend, according to Auguste de St. Hilaire, as far as 34° and 35° . Such, then, are the extreme boundaries of the palm tribe—a line varying from 34° to 44° in the northern hemisphere, and from 30° to 38° in the southern. Beyond these boundaries, and from them to the poles, no palm has ever yet been found living and in a state of nature. It is, however, a very curious fact, that although the great majority of the palm family grow in plains, in a mean temperature of 81° to 86° , and seldom inhabit a country more elevated than 1,900 feet above the sea-level, there are, nevertheless, within the tropics several species of palms, whose natural habitats are at so great an elevation on the Andes as to belong to a climate corresponding with that of the colder temperate or even of the arctic zones. In the "Geography of Plants" it was shown that on mountains, in whatever part of the globe situated, great elevation was invariably connected with depressed temperature, so that for about every 2,000 feet in altitude, a change of climate, temperature, and vegetable productions was experienced, equivalent to about 10° of latitude;

thus, at the limit of perpetual snow, not only the thermometer but the plants indicated an arctic or polar temperature. How strange, then, knowing the *territorial* limits of the palms, that some species should be found braving these polar altitudes. Humboldt found the noble wax-palm, (*Ceroxylon andicola*), the palmetto of Azufzal, (*Oreodoxa frigida*), and the slender and reed-like *Cana de la vibora*, (*Kunthia montana*), all flourishing at elevations varying from 6,400 to 9,600 feet above the level of the sea, where the mean temperature is scarcely 57° Fahr., and in a climate corresponding to that of the south of England and south of France. These palms grow among nuts and oaks (*Quercus granatensis*.) The same enterprising traveller determined by accurate barometric measurements the upper and lower limits of the wax palm. He first observed it on the eastern declivity of the Cordilleras of Quindiu, at an elevation of 7,929 feet, from whence it ascended to the Garita del Paramo and Los Volcancitos as high as 9,700 feet. In the Himalaya range, *Phoenix humilis* is common in the Kherec pass at 2,500 feet above the level of the sea in company with a fir, (*Pinus longifolia*), while *Chamarops martiana* occurs at the height of 5,000 feet; and as this is beyond

the tropical zone, in latitude 28° north, it is equivalent to from 9,000 to 10,000 feet on the Andes of Quito. The distinguished botanist, Don Josè Caldas, found three species of palms in the Parama de Guanacos, near Quito, in the immediate vicinity of the limits of perpetual snow, and therefore, probably, at an elevation of 14,000 feet, and corresponding with the latitude of Iceland.

Many palms, such as the cocoa-nut and the dwarf fan palm, (*Chamærops*,) are peculiar to sea-coasts and the low lands in their immediate vicinity, and do not seem to flourish elsewhere. A very few species are social plants, that is, naturally grow in large clusters, or woods, and not by individuals scattered here and there over the face of the country. (The common heath, the furze, the pines, and firs, are good examples of social plants familiar to ourselves.) Of such among the palms are *Mauritia flexuosa*, the Moriche palm, which tenants the South American savannahs; *Chamærops humilis*, the dwarf European palm which covers whole tracts of land at the estuary of the Ebro and in Valencia; and *Chamærops mocini*, which Humboldt discovered on the Pacific shore of Mexico. It is remarkable, however, that the vast majority of species are confined to very small districts

of the earth's surface, and almost all have their special and peculiar country, out of which they are rarely or never found. Humboldt and Bonpland met with a new species in every fifty miles of travelling, and many botanical travellers have noticed the very local distribution of most of the species. Some few, however, such as the cocoa and date palms, the palmyra, (*Borassus flabelliformis*), and some others, are widely diffused. Of this majestic form of plants, only fifteen species had been described up to the time of the death of Linnæus, which took place in 1778. The Peruvian travellers, Ruiz and Pavon, added only eight; whilst Humboldt and Bonpland, traversing a greater extent of country, (from 12° south latitude to 21° north latitude,) described twenty new species, and distinguished and named as many more, without however being able to procure their blossoms in a perfect state. When Dr. Royle published his illustrations of Himalayan botany, in 1839, he was acquainted with 179 species, of which 119 were American, 14 African, and 42 Indian, and he considered it improbable that that number would ever be doubled. Yet the "*Enumeratio Plantarum*" of Kunth, which appeared in 1841, (only two years later,) contained no fewer than

356 species ; and, up to the present time, 440 species have been scientifically described, including the new East Indian species arranged by Griffith. Much, however, without doubt, remains to be done ; and Von Martius, looking at the vast extent of country in the tropics as yet entirely unexplored, or only very partially investigated by botanists, estimates the total number of palms at not less than a thousand species. It is probable that the greatest number remains to be discovered in the equinoctial parts of South America, and the tropical islands of Asia.

The following observations of Humboldt will show some of the difficulties which beset the examination and study of this noble tribe. "In the space of two years, we have seen as many as twenty-seven species of palms in South America. How many there must have been observed by Commerson, Thunberg, Banks, the two Forsters, Solander, Adanson, and Sonnerat, on their extensive travels! Yet, at the moment I am writing,* our vegetable systems scarcely recognise more than from fourteen to eighteen methodically described species of palms. The difficulties of reaching and procuring the blos-

* This was written during Humboldt's South American travels, about fifty years ago.

soms of palms are in fact greater than can well be conceived: and, in our own case, we were made peculiarly sensible of this, in consequence of having directed our attention especially to palms, grasses, cyperaceæ, and numerous other subjects hitherto much neglected. Most of the palms flower only once a year, and this period, near the equator, is generally about the months of January and February. How few travellers are likely to be in the region of palms precisely during this season? The period of blossoming of particular trees is often limited to a few days, and the traveller commonly finds, on his arrival in the region of palms, that the blossoms have passed away, and that the trees present only fructified ovaries and no male flowers. In an area of 32,000 square miles, there are often not more than three or four species of palms to be found. Who can possibly, during the brief period of flowering, simultaneously visit the various palm regions near the missions on the Rio Caroni, in the Morichales at the mouth of the Orinoco, in the valley of the Caura and Erevato, on the banks of the Atabapo and Rio Negro, and on the declivity of the Duida? There is, moreover, great difficulty when the trees grow in thick woods or on swampy shores (as at the Temi and Tuamini) in reaching the

blossoms, which are often suspended from stems formidably armed with huge thorns, and rising to a height of between sixty and seventy feet. They who contemplate distant travels from Europe for the purpose of investigating subjects of natural history, picture to themselves visions of efficient shears and curved knives attached to poles, ready for securing everything that comes in their way, and of boys who, obedient to their mandates, are prepared, with a cord attached to their feet, to climb the loftiest trees. Unfortunately, scarcely any of these visions are ever realized, while the flowers are almost unattainable owing to the great height at which they grow. In the settlements of the river network of Guiana, the stranger finds himself among Indians, who, rendered rich and independent by their apathy, their poverty, and their barbarism, cannot be induced, either by money or presents, to deviate their steps from the regular path, supposing one to exist. This stubborn indifference of the natives provokes the European so much the more from his being continually a witness of the inconceivable agility with which they will climb any height when prompted by their own inclination, as, for instance, in the pursuit of a parrot, an iguana, or a monkey, which, wounded by their arrows,

saves itself from falling by its prehensile tail. In the month of January, the stems of the *palma real*, our *oreodoxa vesia*, were covered with snow-white blossoms in all the most frequented thoroughfares of the Havannah, and in the immediate vicinity of the city, but although we offered, for several days running, a couple of pistoles to every negro boy we met in the streets of Regla and Guanavacoa for a single spadix of the hermaphrodite blossoms, it was in vain, for in the tropics no free man will ever undertake any labour attended by fatigue, unless he is compelled to do so by imperative necessity. The botanists and painters of the Royal Spanish Commission of Natural History, under count Don Jaruco y Mopox, confessed to us, that for several years they had been unable to examine these blossoms, owing to the absolute impossibility of obtaining them. After this statement of the difficulties attending their acquisition, the fact of our only being able, in the course of two years, to describe twelve species of palms, though we had discovered twenty species, may be understood, but I confess it would hardly have been credible to me before I left Europe."

CHAPTER III.

THE PALMS OF EUROPE AND AFRICA.

WE now proceed to a detail of facts connected with the more interesting and important out of the 440 species which constitute the tribe of palms, so far as at present known and described. In so doing, we will take those first which are found native in the continents of Europe and Africa. In Europe, we have but two species—*Chamærops humilis*, the dwarf fan palm, which is abundant in Spain and Italy, as also in the north of Africa, covering large tracts of land in those countries; and the date palm, (*Phoenix dactylifera*,) which is, however, probably not an original native of Europe, but has been introduced into Italy and Spain from Africa.

The date palm is one of the best known, and probably the earliest known of all the palms; and though belonging to a family which abounds and flourishes mostly in tropical regions, itself attains perfection only in comparatively high latitudes. It is no doubt the species to which

the name "palma" was originally applied, as we may infer from its being common in Syria, Arabia, the lower parts of Persia, as well as Egypt and the north of Africa, from whence it has probably been introduced into the south of Europe. It is also thought that the name is not applicable to the other species known to the ancients, because the bunches of fruit were likened to the fingers of the hand, and this likeness is expressed in the specific name of the present species, "*dactylifera*," from the Greek *daktulos*, a finger. It was once very abundant in regions where now it has almost disappeared. It formerly grew round Palmyra; and that city is supposed to have been named from its abundance there; for "Palmyra" is but a translation of its oriental name "Tadmor," supposed to be a corruption of "tamar," a date. It was the city which Solomon built in the Syrian desert, probably for the purpose of controlling and increasing the trade with eastern Asia. It has now, however, become a ruin, and with its downfall the palm has nearly disappeared from its vicinity. The tree has also almost vanished from the Holy Land, though once so plentiful there as to be the emblem of the country, for we find it so depicted on the medals which commemorate the victories of Vespasian and Titus;

while upon a medal of Domitian, it is delineated as an emblem of Neapolis, or Naplosa, the ancient Sichem ; and upon another of Trajan, it appears as the symbol of Sepphoris, the metropolis of Galilee. It was prosperous in the prosperous days of these places, and has become desolate with their desolation ; and the inscription of "*Judæa capta*," which, with a palm, and a woman sitting weeping at its foot, is the symbol of the overthrow of the Jewish nation on the coins of that date, mournfully expresses not only its connexion with the Holy Land, but the wretched state of its inhabitants, brought upon them by their sins, and especially by their rejection of the Son of God. The plain of Jericho, the ancient city of palms, was once covered with date groves, but they have vanished, and a solitary palm scattered here and there is all that is now to be seen, where multitudes formerly adorned the plain and supplied the inhabitants with their fruit. At Jerusalem, Sichem, and other places to the north, two or three palms are rarely seen together, and even these, as their fruit seldom or never comes to maturity, are of no further service than, like the palm-tree of Deborah, to shade the dwellings of the inhabitants, and supply them with branches at their solemn festivals.

Although it has thus vanished from some districts of which it was formerly the prominent feature, it still crowns others with its beauty, and enriches them with its produce. It grows along the Euphrates to Bagdad and Bassorah, and along the coasts of the Persian Gulf even to India, where it is common in Gujerat, though it does not ripen its fruit well there. Very extensively is it cultivated in Arabia and the gardens of Medina; and the valleys of Safra and Jedeida, on the route to Mecca, are renowned for their extensive plantations of date palms, and for the excellence of the fruit they yield. At Safra, the date plantations are four miles in length. So abundant is it, and so unmixed with any other tree in the country between the states of Barbary and the desert, that this region is designated the land of dates, (*Billedulgerid*;) and upon the last plain as the desert is approached, the only objects that break the dull outline of the landscape are the date palm and the tent of the Arab. The same tree accompanies the margin of the desert in all its sinuosities; in Tripoli, in Barca, along the valley of the Nile, in the north-east of Arabia, and in the south-east of Turkey. On the northern borders of the Great Desert, too, at the foot of the Atlas mountains, the

groves of date palms form the great feature of that parched region, and few trees besides can maintain an existence. The excessive dryness of this arid tract, where rain seldom falls, is such that wheat refuses to grow, and even barley, maize, and Caffre corn, (*Holcus sorghum*,) afford the husbandman only a scanty and uncertain crop. The hot blasts from the south are scarcely supportable even by the native himself, and yet here forests of date palms flourish, and form a screen impervious to the rays of the sun, beneath the shade of which the lemon, the orange, and the pomegranate, are cherished, and the vine climbs up by means of its twisted tendrils; and although reared in constant shade, all these fruits acquire a more delicious flavour than in what would seem a more favourable climate. How beautiful a comment do these facts supply to the words of Holy Writ, "The righteous shall flourish like the palm tree!" Unmoved by the scorching and withering blasts of temptations or persecution, the Christian, sustained by the secret springs of Divine grace, lives and grows in likeness to his Divine Master, when all others are overcome, and their professions wither. How striking is the contrast in the psalm just quoted! The wicked and worldlings are com-

pared to grass, which is at best but of short duration, and which is easily withered; but the emblem of the Christian is the palm tree, which stands for centuries. Like the grateful shade of the palm groves, the Christian extends around him a genial, sanctified, and heavenly influence; and just as the great value of the date palm lies in its abundant, wholesome, and delicious fruit, so do those who are the true disciples of Christ abound in "fruits of righteousness," for, said our Saviour, "Herein is my Father glorified, that ye bear much fruit; so shall ye be my disciples." A holy life, a spirit of devotion, the victory over the passions and temper, the love of God in the heart, and the untiring benevolence which seeks the temporal and spiritual good of man—these are "fruits" by which God is glorified and others edified. "The fruit of the Spirit is love, joy, peace, long-suffering, gentleness, goodness, faith, meekness, temperance." Oh! when shall the children of Adam's fallen race, taught by that Spirit, display these heavenly dispositions! How glorious will such a period be! how different from what we now witness!

Though some of the palm family are more majestic than the date palm, it is still a very beautiful tree. Rearing its stem and expanding

its broad and beautiful head where there is nothing else to shelter man from the burning rays of the sun, the palm tree is hailed by the wanderer in the desert with more pleasure than he hails any other tree in any other situation. Nor is it for its shade alone, or even for its fruit, that the palm is so desirable in that country, for wherever a little clump of palms contrast their bright green with the red wilderness around, the traveller may in general be sure that he shall find a fountain ready to afford him its cooling water. Its stem shoots up in one cylindrical column, to the height of fifty or sixty feet without branch or division, and is of the same thickness, or nearly so, throughout its full length. When it attains this height, its diameter is from twelve to eighteen inches. From the summit of this majestic trunk, it throws out a magnificent crown of leaves, which are equally graceful in their form and arrangement. The main stems of these leaves are from eight to twelve feet long, firm, shining, and tapering; and each embraces as its base a considerable part of the trunk. The trunk of the palm is, in fact, made up of the remains of leaves, the ends of which are prominent just under the crown, but more obliterated towards the root of the tree. The bottoms of the

leaf-stalks are enveloped in membranous sheaths, or fringed with very tough fibrous matter. The leaves are pinnate or feathered, and the leaflets are alternate, and of a bright, lively green. Near the base of the leaf, these leaflets are often three feet long, but even then they are not one inch in breadth, neither do they open flat, but remain somewhat folded, with a ridge in the middle like the keel of a boat. Before they expand, they form a conical bud in the centre of the crown of leaves, and are so closely packed one upon another, as to form a mass called "the cabbage," from its likeness to that vegetable. It is a delicate esculent, and in taste much resembles a fresh chesnut; but as the removal of it would occasion the death of the tree, it is seldom used except in those trees which are cut down for the sake of the sap or juice. When the leaves are young, they are twisted together and matted up with loose fibres, which open and disperse as the leaf expands. The young leaflet is also armed at the extremity with a hard, black spine or thorn. The leaves are firmer and more stiff than those of any ordinary tree. It should be observed, that the lower leaves of the crown droop and wither every year, and are cut off at the base in such a manner that the stumps left upon the trunk,

from the base to the leafy top, give the stem a remarkable appearance, and have the advantage of serving as steps to enable persons to ascend to the summit, which would otherwise be a very difficult enterprise. This ascent is necessary, not only to lop off the decayed leaves, but to impregnate the fruit-bearing blossoms with pollen. The fibrous character of the stem, composed of the roots of leaves, (as before explained,) renders the trunk useless as timber—indeed it cannot be called timber, though very valuable for other purposes.

The date palm reaches its full maturity in about thirty years, (though it bears fruit much earlier,) and continues in full productiveness and perfect beauty for about seventy years longer. After this, it begins gradually to decline, and perishes towards the latter end of its second century. This may serve as a general statement, but it is liable to large exceptions. Trees far more than two centuries old have been known; but perhaps the best general rule is afforded by the popular expression of the Arabs, which states that after the date tree has attained maturity, it remains in undiminished vigour during three human generations. "They shall still bring forth fruit in old age; they shall be fat and flourishing," is the description which

the psalmist gives of the servants of God, when comparing them with this noble tree ; and very appropriate is the simile—

“ Laden with fruits of age, they show
The Lord is holy, just, and true.”

“ Other trees,” says good Matthew Henry, “ when they are old, leave off bearing ; but in God’s trees the strength of grace does not fail with the strength of nature. The last days of the saints are sometimes their best days, and their last work their best work.”

The fruit is produced in clusters, which grow from the trunk of the tree between the leaves. In a good tree and productive season, there may be from fifteen to twenty of these clusters, each weighing about as many pounds ; but this differs with differing circumstances and in different varieties, of which there are many. The same variation extends to the size and quality of the fruit itself. Almost every district, indeed, has its own variety, which grows nowhere else. Burckhardt was informed that upwards of one hundred sorts grew in the immediate neighbourhood of Medina ; and a native historian, in his description of that city, has enumerated one hundred and thirty. The cheapest and most common kinds are called the *jebelé*, the *haloua*, and the *heleya*, a very small date, not larger

than a mulberry ; it has its name from its extraordinary sweetness, in which it equals the finest figs from Smyrna ; and, like them, when dried, is covered with a saccharine crust. This was the date with which Mohammed is alleged to have performed a very great miracle, by planting a kernel in the earth, which instantly took root, grew up and in five minutes, became a full grown tree loaded with fruit. Another miracle is related of the kind called "*El syhani*," which hailed the prophet as he passed under it with a loud "*Salaam aleikoom*." The *birni* is esteemed the most wholesome and the easiest of digestion. Mohammed, with whom it was a favourite, recommended the Arabs to eat seven of them every morning before breakfast. They are in great request with the hajjis, (or pilgrims,) who always carry some of them home as presents to their friends. They are bought in small boxes holding about one hundred. One variety of the Medina date remains perfectly green even when ripe and dried ; another retains a bright saffron colour. These are threaded on strings and worn as ornaments by children, or sold under the name of *Kalaydes Siam*—Necklaces of the North. In wady Feiran, Burckhardt mentions the *jamya* as the best kind, of which the monks of Sinai send

large boxes annually to Constantinople as presents, after having taken out the kernels and put an almond in their place. Dates that are intended to be dried are not allowed to attain their softest condition. Great quantities are thus preserved, and are then very hard, and have a shrunk and shrivelled appearance. They are, in this state, of great service as a standing article of food, and from their hardness and portability are very valuable to persons on a journey. Dates are dressed in a variety of ways; they are boiled, stewed with butter, or reduced to a thick pulp by simmering in water, over which honey is poured. It is a saying with the Arabs, that "a good house-wife may furnish her husband every day for a month with a dish of dates differently prepared." About one thousand hundredweight of dates are said to be annually imported into England, especially from Barbary. The Tafilat date is also much esteemed among us. Dried dates are sometimes made into a kind of flour, which frequently forms the entire sustenance of the caravans of the desert, and will keep for a length of time if preserved from damp. The date has an exceedingly hard and solid kernel, which is sometimes used by the turner for ornaments; in Barbary, the natives form hand-

some beads for paternosters from them. The chief use of date kernels is, however, as a nourishing and acceptable food for camels, cows, and sheep. For this purpose they are, in some places, softened by being soaked for two or three days in water, and in others they are ground to powder for the same purpose. They are said to be more nutritious than barley. In Medina, there are shops where nothing else is sold but date stones, and, in all the main streets, beggars are occupied in picking up those that have been thrown away.

A considerable number of the inhabitants of Egypt, Persia, Arabia, the north of Africa, and especially the wandering tribes of the Great Desert, derive their support and subsistence almost entirely from this fruit. The season of gathering is, therefore, watched for with all the anxiety, and attended with all the rejoicing of the harvest in the middle, or of the vintage in southern Europe. A failure of the crop, either from the ravages of locusts, or the exhaustion of the trees, which are seldom known to produce abundantly more than three or four years in succession, causes general distress, and spreads universal gloom over the inhabitants. The fruit does not all ripen at the same time, each variety having its particular season. The

harvest of dates at Medina continues for two or three months, from July to September, but dates are eaten by the beginning of June.

From the value of the fruit, the culture of the date palm has received much attention, and the date plantations are carefully tended, and watered by artificial means. One of the most important points in the cultivation of this tree, is the provision of sufficient quantities of male blossoms to fertilize (or "set," as gardeners say,) the fruit with their pollen. We have already alluded to the diœcious nature of this palm, and the need of artificial application in order to insure the ripening of the fruits. For this purpose the pollen is conveyed to the female flowers just as they are about to burst from their sheaths; this is done in the end of March, or the beginning of April. A sprig or two of the male cluster is taken and introduced into the spathe of the female; or else they take a whole cluster of the male tree, and sprinkle its pollen, or farina, over several clusters of the female. This latter practice is common in Egypt, where the proportion of male trees is unusually numerous; but in Barbary and Arabia the other method is resorted to, as under it one male tree is sufficient for four or five hundred female palms. Of the necessity

of this precaution, a remarkable instance is related by Delile, in his *Egyptian Flora*. The date trees in the neighbourhood of Cairo did not yield a crop in the year 1800. The French and Turkish troops having been fighting all over the country in the spring, field labour of every kind was suspended, and among the rest the fecundation of the date. The female date trees put forth their branches of flowers as usual, but not one of them ripened into edible fruit. The pollen of the male trees appears to have been scattered over the country by the winds; and as it had not been sufficiently abundant for reaching the germs so as to insure fructification, an almost universal failure was the consequence. The Persians, according to the elder Michaux, who travelled in the country, were more provident than the Egyptians. In a civil war, which was attended with all the ruinous effects of anarchy, the male date trees of a whole province were cut down by the invading troops, that the fructification of this necessary of life might be stopped. But the inhabitants, apprehending such a result, had been careful previously to gather the pollen, which they preserved in close vessels, and thus were enabled to impregnate their trees when the country was freed from the destroying

army. It is said that pollen has thus preserved its powers during nineteen years.

Palm trees form a valuable property, and confer importance on their owners; and so much is this the case that there is an Arabic proverb reflecting on the custom for persons who affect consequence to which they have no claim to pretend that the dates they consume are produced by trees of their own.* Date plantations are described as forming very beautiful scenes; with summits perpetually fresh and green, and upheld in a majestic succession of colonnades, they have been happily compared to a temple of nature, representing one eternal spring. The date groves round Medina are cultivated by farmers, who are taxed by the Wahabees, according to the number of trees in each field; and not only is the produce of the groves and gardens thus mulcted, but heavy assessments are imposed even upon the water used in irrigating them. For every erdeb of dates the tax-gatherers levy their quota, either in kind or in money, according to the current market price. Each small grove is inclosed by a mud or stone wall, and interspersed with hamlets or low insulated huts. The trees pass from one individual to another in the

* Burckhardt's Arabic Proverbs, No. 126.

course of trade; they are sold singly according to their respective value, and often constitute the dowry paid by the suitor to the bride's father on marrying her. The sand is heaped up round their roots, and must be renewed every year, as it is usually washed away by the torrents from the hills, which sometimes form a brook, twenty feet broad and three or four deep. Among the date groves of wady Feiran, Burckhardt observed several doum palms, as well as in other parts of the peninsula. They belong to the Tebna Arabs, and during the five or six weeks of the harvests, the valley is crowded with people, who erect temporary huts of palm branches, and pass their time in great conviviality. At Dahab, the plantations have a very different appearance from those in most other places. The lower leaves, instead of being taken off annually, are suffered to remain and hang down to the ground, forming an almost impenetrable barrier round the tree, the top of which only is covered with green leaves. A similar palm tree, found growing wild in the Sinai mountains, and thus clothed with drooping and dead leaves, which completely conceal the trunk, is engraved by Laborde in his "Visit to Petra," and is copied in the Pictorial Bible, and

in the Illustrated Commentary, under the text, Exod. xv. 27.

In the east it is quite usual for trees to be planted in the courts both of religious houses and domestic habitations ; and while residing in the countries of the date palm, Dr. Kitto observed that it was almost invariably employed for that purpose. It is equally recommended to this preference by the elegance of its form, the excellence of its fruit, and the broken shade which its spreading head diffuses over the court in which it is placed. Referring to the palm, or rather continuing the comparison of the Christian with that tree, and doubtless with this custom in view, the psalmist says, "Those that be planted in the house of the Lord shall flourish in the courts of our God." As Matthew Henry remarks, "Let Christians aim to excel, that they may be eminent and may flourish, and so adorn the doctrine of God their Saviour, as flourishing trees adorn the courts of a house." The expression may also refer to the source whence Christians derive all that is really excellent in them, because "it is from God's grace, by his word and Spirit, that they receive all the sap and virtues that keep them alive and make them fruitful."

From the leaves of the date palm, couches,

baskets, bags, mats, brushes, and fly traps are manufactured; and boats constructed solely of this material are used on the Tigris; while the threads of the web-like integument at their base are twisted into ropes, which are employed in rigging small vessels. The trunk is split, and used in small buildings, also for fences to gardens, and for rafters; and the stalks of the leaves are made into cages for poultry. The sap is said to be obtained by cutting off the head of the palm, and scooping out a hollow in the top of the stem, where, in ascending, it lodges itself. Three or four quarts of sap may be obtained daily from a single palm for ten days or a fortnight, after which the quantity lessens, until at the end of six weeks or two months, the stem is exhausted, becomes dry, and is used for firewood. This liquor is sweetish when first collected, and may be drunk as a mild beverage; but fermentation soon takes place, and a spirit is produced, which is sometimes distilled, and then forms one of the kinds of arrack of eastern countries. This palm wine, as the unfermented sap is termed, is believed to be the liquor alluded to in various places in Scripture, under the name "strong drink." Thus in Isaiah xxiv. 9, bishop Lowth translates the passage:—

“ With songs they shall no more drink wine, (*i.e.*, of grapes,) The *palm wine* shall be bitter to them that drink it.”

And he observes that this is the proper meaning of the word. The same liquor, in a concentrated syrupy form, or the thick sweet juice of the dates, seems to be referred to under the same title, as in Prov. xxxi. 6; and under the name of honey in other passages, as in Gen. xliii. 11, “ Carry down the man a present, a little balm, and a little *honey*, spices, and myrrh, nuts, and almonds;” and Prov. xxv. 16, “ Hast thou found honey? eat so much as is sufficient for thee, lest thou be filled therewith, and vomit it.” Such being the importance and multiplied uses of the date palm, it is not surprising that in an arid and barren country it should form so prominent a subject of allusion and description in the works of Arabian authors, and that it should be said to have three hundred names in that language. Many of these are, however, applied to different parts of the plant, as well as to those at different ages.

But valuable as the date palm is, as a tree all of whose products are distinguished by great economical importance, it is invested with surpassing interest on account of its associations. It is the “ palm tree ” of Scripture, to which such frequent references are made throughout

the sacred volume. It was one of the trees with which the Israelites were directed to construct the temporary tents in which they were to dwell during the feast of tabernacles. "And ye shall take you on the first day the boughs of goodly trees, branches of palm trees, and the boughs of thick trees, and willows of the brook; and ye shall rejoice before the Lord your God seven days," Lev. xxiii. 40. In later days, the Pharisees and Sadducees maintained a controversy on the point, whether these branches were to be used in making booths, or were to be carried in procession. The latter was insisted on by the Pharisees, and it is also the sense given by Josephus, and was probably that acted on in our Saviour's days, as it is still the practice maintained by the modern Jews. When the observance of the religious institutions of the Jews was restored by Nehemiah, after their neglect in consequence of the captivity, they sought instruction from the Scriptures. "And they found written in the law which the Lord had commanded by Moses, that the children of Israel should dwell in booths in the feast of the seventh month: and that they should publish and proclaim in all their cities, and in Jerusalem, saying, Go forth unto the mount and fetch olive branches, and pine branches, and myrtle

branches, and palm branches, and branches of thick trees to make booths, as it is written."

This feast was instituted in commemoration of their dwelling in tents during their sojourn in the wilderness, to remind them of God's mercy, and of his dealings with them while wandering from Egypt to Canaan. We know not why the palm was appointed to be used; perhaps to denote their joy, perhaps in token of their triumph over their enemies, possibly to remind them how God had provided rest and refreshment for them beside the fountains and beneath the palm trees of Elim. It was beneath a palm tree that Deborah dwelt, or, as some understand it, sat, when she administered judgment among the children of Israel; and the "palm tree of Deborah" was well-known and oft resorted to by the tribes, which were then under the heavy yoke of the Canaanites.

The straight and elegant stature of the palm is used in Solomon's Song as the emblem of the beauty and strength of the church. "This thy stature is like the palm tree;" and the delight of Christ in his church, his kind purposes toward it, are expressed under the same figure in the passage following, "I said, I will go up to the palm tree; I will take hold of the branches thereof." Homer uses the same com-

parison when Ulysses likens the princess Nausicaa to a young palm tree growing by the altar of Apollo in Delos. The same figure is used in another part of holy writ to express the vanity of idols. The prophet Jeremiah, in his ironical exposure of the folly of idol-worship, says, "They are upright as the palm tree, but speak not: they must needs be borne, because they cannot go." However stately it may appear, even though elegant as the prince of trees, it is but a senseless, helpless log. Or it may refer, as Calmet thinks, to the shape of the idols of the heathen, which were of nearly equal thickness throughout, the hands hanging close to the sides, the legs close together, and in a very perpendicular attitude, "upright as a palm tree." Such are the figures of Egyptian idols that remain to this day.

Dates are probably alluded to in 2 Chron. xxxi. 5, (for so the word rendered *honey* in our version should, it is thought, have been translated, and it is so given in the margin,) as part of the tithes which the people readily brought in for the support of the priests and Levites, when Hezekiah effected his great reformation. "As soon as the commandment came abroad, the children of Israel brought in abundance the first-fruits of corn, wine, and oil, and *dates*,

and of all the increase of the field." And may not this circumstance, and the blessing which descended upon the Jews for their liberality in this instance, remind Christians in the present day, both of their far greater obligations to remember that God claims not only their hearts but their wealth for his service, and also of the gracious promise of personal blessing upon such a consecration of their property? "Prove me now herewith, saith the Lord of hosts, if I will not open you the windows of heaven, and pour you out a blessing, that there shall not be room enough to receive it." Which of our religious institutions would have to lament over their want of success, and the feebleness of their progress from lack of funds, if Christians had but full faith in this promise? There is another interesting allusion to the date, as one of the most important of the fruits of the Holy Land, in Joel i. 12—when, describing God's heavy judgments, and showing how easily he can humble and chastise the proudest by withholding those fruits of the earth which are necessaries of life, the prophet says, "The vine is dried up, and the fig tree languisheth; the pomegranate tree, the palm tree also, and the apple tree, even all the trees of the field are withered: because joy is withered away from

the sons of men." To a dweller in those eastern climes this would convey the idea of an appalling famine.

The elegance of form in the trunk, but especially in the foliage of the palm, together with its special connexion with the Jews as a people, its abundance in their land, and their dependence on it as an article of sustenance,—all contributed, doubtless, as reasons for its choice as one of the models selected for the ornamental carvings in the magnificent temple of Solomon, in which it bore a very conspicuous place. "And he carved all the walls of the house round about with carved figures of cherubims and palm trees." "The two doors also were of olive tree; and he carved upon them carvings of cherubims and palm trees, . . . and overlaid them with gold." "And the greater house he ceiled with fir tree, which he overlaid with fine gold, and set thereon palm trees and chains." It is also mentioned as an ornament of the temple of which so elaborate a description is given by Ezekiel, "And upon each post were palm-trees," Ezek. xl. 16, and several other passages. The palm is especially the emblem or symbol of triumph, and this obtained both amongst believers and idolaters. It was with the leaves of palm trees that the multitude who accompanied

Jesus in his triumphal entry into Jerusalem, met him as he came from the Mount of Olives, either bearing them in their hands in procession, or strewing the path as he rode along, as it was customary to do in the triumphs of princes and distinguished conquerors. "When they heard that Jesus was coming to Jerusalem, they took branches of palm trees, and went forth to meet him, and cried, 'Hosannah: Blessed is the King of Israel that cometh in the name of the Lord.'" In the book of Maccabees, the triumphal entry of Simon into Jerusalem is described as being accompanied "with thanksgiving, and branches of palm trees, and with harps and cymbals, and with viols, and hymns, and songs," 1 Mac. xiii. 51. In the same apocryphal narrative, the triumph of Judas Maccabeus is described, who, after the death of the persecutor Antiochus, cleansed the temple and the city of Jerusalem, and held the feast of tabernacles. "Therefore they bare branches and fair boughs, and palms also, and sang psalms unto him that had given them good success in cleansing his place," 2 Mac. x. 7. And it is with a similar import that the allusion occurs in Rev. vii. 9, 10, "After this I beheld, and, lo, a great multitude, which no man could number, of all nations, and kindreds, and

people, and tongues, stood before the throne, and before the Lamb, clothed with white robes, and palms in their hands; and cried with a loud voice, saying, Salvation to our God which sitteth upon the throne, and unto the Lamb." The palms which the redeemed in heaven are represented as bearing, signify their triumph and victory over all their spiritual enemies, and their rejoicing in the presence of Christ their Lord—They shall be more than conquerors through Him who hath loved them. And who would not wish to share their triumph, to join their anthems of praise, and to swell the number of those who are thus purified from every sin, freed from every sorrow, and made partakers of holiness and happiness, infinitely exceeding all that man ever knew since he fell? There is one way, and but one, yet it is a way open to all, by which every sinner to whom the glorious message is sent may hereafter join that holy, happy band. It is by faith in Jesus Christ alone that we can be made meet for the inheritance. We must repent of sin, and seek the sanctifying and purifying influences of the Holy Spirit by earnest, believing prayer. We cannot deserve this blessing—we must cast ourselves, by faith, on the mercy of God, extended to us through the merits and sacrifice

of Christ. Our own righteousness will be of no avail, for we all have sinned, and are all exposed to the condemnation of God's holy law. But the great salvation is offered freely, without money and without price, to all alike; and whosoever will may come and take of the water of life freely. It is God's greatest, God's free gift; and will be bestowed on every one, however unworthy, who feels deeply his need of it, and seeks it in the appointed way: "Believe on the Lord Jesus Christ, and thou shalt be saved:" "Him that cometh to me I will in nowise cast out."

Next to the date tree, the most important of the palms of Africa is the oil palm, (*Elais Guineensis*.) It grows in abundance on the tropical parts of the west coast of Africa, especially in Guinea and Congo, where it is called *maba*. It is also cultivated to some extent in gardens and coffee plantations in South America, where it has been introduced from Africa. It belongs to a large section of the palm tribe, called *Cocoeæ*, the members of which are very numerous, (embracing fifteen genera,) and agree in general character with the cocoa nut palm. It is singular that all these palms, with the exception of this one and the cocoa nut, (*Cocos nucifera*,) should be confined to America, and

that these two extra-American species should be the most important of the whole section. It is to be noticed, however, that the cocoa nut is exceedingly abundant in America, and that the *Elais* is cultivated in South America, and is perhaps identical with the West Indian *Elais occidentalis*, a palm found throughout those islands, the thatch tree of Brown's Jamaica.

It derives its name from *Elaiia*, the olive tree, because an oil is yielded by the fruit of its principal species. The stem is tall, twenty or thirty feet high, the upper part of which (and sometimes almost the whole stem) is clothed and completely concealed by the leaf stalks, which remain after the leaves are decayed and have dropped off. These leaf stalks are broad, and are edged with strong thorns, and give the trunk somewhat the appearance of being beset with the blades of great double-edged saws; the leaves are twelve to twenty in number, and nearly erect, forming a splendid crown. They are from ten to fifteen feet long, and winged with very numerous sword-shaped leaflets, each about eighteen inches in length. The fruit is of an oval shape, and varies from the size of a pigeon's egg to that of a hen's. It is quite smooth, of a rich yellow colour, and red on one side. It is composed of a thick, oily, fungous

flesh, in the centre of which is a very small hard nut, and it has a strong odour of violets. The fruits are very numerous, six hundred or eight hundred in number, and are densely crowded upon the upright spadixes; and the brilliant red colour of these huge masses of fruit, contrasted with the bright green of the towering and graceful leaves, and these surmounting the very singular and formidably armed stem, together form one of the most curious, yet beautiful objects in the vegetable creation. The great value of this palm lies in its fruit, from which is extracted an oil, now becoming an important article of commerce, under the name of "palm oil." It is obtained from the fleshy part of the fruits, which for this purpose are exposed for some days to the sun; they are then bruised, and the crushed paste is subjected to boiling water in wooden mortars, and afterwards tightly pressed through cloth, when a large quantity of a limpid, clear, orange yellow oil separates, which has scarcely any taste, but exhales a powerful odour of violets, and hardens, when cool, to the consistence of butter. It is used by the native Africans universally for anointing the body, and also for the same purposes as butter with us. It is likewise much esteemed for preventing the attacks of the chigoe, (*Pulex penetrans*.)

and for healing wounds occasioned by them. But its great use is as an article of commerce to Europe, where it is applied to various purposes. In the year 1841, the large quantity of 168,528 hundredweight was imported, and now it has reached upwards of 400,000 hundredweight annually, worth more than £600,000. When the slave trade was first abolished the quantity of palm oil imported was very trifling; but it has been shown in evidence before a committee of the House of Commons, that the increased consumption of palm oil had led to the employment of a vast number of persons, who would otherwise be engaged in the slave trade. This increased commerce of Africa in a legitimate commodity, is interesting as a proof of the correctness of judgment in one of the earlier friends of negro emancipation, whose very name seems to have been forgotten in the long list of the honoured friends of that cause. Mr. Thomas Bentley, of Liverpool, a predecessor of Sharp, and Clarkson, and Wilberforce, was sagacious enough to perceive, and bold enough to maintain, when a merchant in that slave-trading port, that some articles existed in Africa more suited to the commerce and conscience of England than negroes. He told his fellow-townsmen, that they should send their ships,

not for slaves, but for palm oil ; and now it is for that very palm oil that the fleets are sent, which, but for the efforts of such men as he, would still have been groaning with human victims. Mr. Bentley was subsequently connected with Wedgwood in his famous pottery, to the beauty of which his excellent taste greatly contributed. Palm oil enters largely into the composition of some kinds of soap, and is used in immense quantities as a lubricant for machinery. But it is in the manufacture of candles that palm oil is now coming into most extensive use, and although only a few years ago it would have been thought impossible to apply so soft and oily a material to that purpose, yet, by the aid of chemical science, not only is the difficulty conquered, but candles have been produced fit for the table of the nobleman. We may give a brief description of the process as it is pursued in the largest establishment of the kind in London. Into each cask, as it is landed on the wharf, a steam pipe is introduced, and the heat which the steam imparts soon melts the palm oil into a liquid. It is then pumped into large receiving vessels, where, by the application of certain chemical ingredients, its orange yellow colour vanishes, and is changed to a dirty white. By other pro-

cesses all remaining discoloration is expunged, and on parting with its heat, and again becoming solid, it has a pure white colour, as free from stain as the driven snow. The next step is to spread it out in thin layers on the surface of mats made of cocoa fibre, which, after receiving their coating of oil, are piled one upon another into high stacks, an iron plate being interposed between every pair of mats to counteract the elasticity of the fibre. The pile of oiled mats is then placed beneath a powerful hydraulic press, by which an immense pressure can be applied, equivalent to a weight of many hundreds, perhaps thousands of tons. It will be necessary here to explain that most fixed oils are composed of two substances or principles, called by chemists *stearin*, and *elain*, or *olein*, which may be separated by mechanical means. The former of these is usually solid, and the latter liquid at the ordinary temperature of the air. Now palm oil contains both these principles, and by means of the hydraulic press they are separated, the *stearin* remaining between the cocoa mats, while the *olein*, as the pressure increases, trickles down the sides of the pile, and is received in vessels placed beneath for that purpose. But the utmost power of the hydraulic press is insufficient at ordinary tem-

peratures entirely to free the *stearin* from its more liquid companion; and the pile of mats, after being pressed, are taken to another press in a room where the air is kept heated by steam to 120° Fahrenheit. Here they are again submitted to pressure of equal power with the former, by means of which the remaining portions of *olein* are finally expelled. The mats are now separated, and the *stearin* is peeled off from them, looking like flakes of spermaceti. It is now consigned to a vat, where it is melted by means of coils of steam-pipes, and when completely liquefied, it is ready to be run into the moulds, which are heated by steam to a certain temperature before being filled with the liquid material. The object of this precaution is to prevent the *stearin* from congealing as soon as it comes into contact with the metal of the moulds, which it would do if they were cold, as they formerly used to be, a circumstance which rendered the candles imperfect or unsightly. In order to prevent this, the liquid *stearin* was heated to 240°, and a small quantity of arsenic was added, which obviated the difficulty, but rendered the candles somewhat unhealthy for use. Every obstacle is, however, now removed by the above method of heating the moulds, and the only wonder is, as

in many other great improvements, that so simple a plan should not have been thought of sooner.

Such is a slight sketch of the application of palm oil to the purpose of candle-making; and when we further state that these candles can be retailed at prices from sevenpence-halfpenny per pound and upwards, according to the quality, that they require no snuffing, that they give a far greater light than any tallow candle, and burn longer than the best moulds, it gives us a good idea of the useful applications of sciences which by some are thought a needless waste of time. They will probably eventually quite supersede tallow candles, for the manufacture is but of very recent date, and doubtless many improvements will yet be made in it.

The increasing consumption of palm oil is closely connected with the progress and civilization of the coast tribes of western Africa, and as it is from them that the slave market is chiefly supplied, it will be an object of importance to encourage as far as possible a trade which bids fair to be a successful rival to one which is of so degraded a character, and which has been such a bitter curse to all connected with it. At the same time, we must ever

remember that civilization is best and most securely based upon Christianity, and that the introduction of the gospel among those savage nations is the most effectual means of advancing their temporal condition—of abolishing the hellish traffic which has so long flourished among them—and of promoting the legitimate ends of commerce, as well as of advancing their best and highest interests. The palm oil trade has, however, some disadvantages in competing with the slave trade. One of these is the fatal character of the malaria which rises from the low lands that bound most of that part of the African coast where the palm grows, especially the delta of the Niger. The sad result of the Niger expedition shows that we cannot hope to contend against this fearful scourge, to which Europeans appear especially liable. The natives seem to be less susceptible of its influence, so that by the selection of the more healthy ports, aided by native co-operation, this difficulty may be overcome in time. The palm oil trade is actively engaged in at some places, as at Eboe, on the Niger, governed by king Obie, who boasts that he is the greatest of the palm oil kings. Eboe is believed to contain fifty or sixty thousand inhabitants, who are the most enterprising and industrious

traders on the river. Another hindrance to the trade is in the native disposition, the indolence and warlike character of which is far from falling in with the steady, patient, persevering labour that the cultivation of the palm, the manufacture of the oil, and the needful preparations for its exportation require. Still, if missionary labour can be successfully prosecuted among them, the instances of Tahiti and the South Sea islands teach us how great may be the change, both in their religious and social character.

The doum palm (*Hyphæne Thebaïca*) is the only other African palm at present known that requires special mention. It is a native of Egypt, and is occasionally found also in Arabia. It is especially remarkable as being one of the very few palms that have branched stems. The trunk, instead of being simple, as in most palms, divides into two branches at some height from the ground, and these are again forked in like manner; and this repeated division of the branches gives the tree more of the appearance and external character of an European tree than of a palm. The leaves are palmate, and the fruit is roundish, having a hard kernel, surrounded with a thick, brown, mealy rind, which so nearly resembles gingerbread as to have

procured for the tree the name of "gingerbread tree." The kernels are turned into beads for rosaries. It also yields a kind of gum-resin, which bore the name of Egyptian Bdellium, and was formerly esteemed a valuable medicine, though it has now no repute. Another species of this genus (*Hyphæne coriacea*) has a similarly forked stem, and is found on the eastern coast of Africa, at Melinda, 3° south latitude, and extends as far as Natal, 30° south latitude, though by some authors the Natal plant is described as still another species, (*Hyphæne Natalensis*.)

We have nothing to relate of interest as regards the other African palms, but the interiors of both Africa and Madagascar are so little known, especially to botanists, that very many palms which are now entirely unknown, will probably be discovered in both the continent and the island, and they may be found to yield products of great importance to the commerce and welfare of Africa.

CHAPTER IV.

THE PALMS OF ASIA.

FROM Europe and Africa we turn to the eastern palm world, and here we find a much more extensive field for observation and inquiry. From one hundred to two hundred species of palms are known to inhabit this continent, many of which are eminently useful to man; and doubtless many more remain to be discovered, and many, even among those already known, may be found to possess important economical uses, of which at present we are ignorant.

First and foremost among the Asiatic palms stands the cocoa nut, (*Cocos nucifera*), "the palm of palms" as it has sometimes been termed, and often selected as a type of the useful endowments of the order. That learned traveller was right who said that it seemed as if nature had epitomized in the cocoa nut the whole of the invaluable properties she had diffused among the family of palm trees. The

name "cocoa" is probably a contraction, or rather corruption of the Portuguese word *macoco*, or *macaco*, a monkey, and is supposed to have been given from the resemblance between the end of the shell of the fruit, where the three black scars are, and the face of a monkey. The natives say that the cocoa nut is a tree delighting in the society of man; and it is certain that it thrives best near his dwellings, since it is the custom of the people to deposit the refuse of their huts at the foot of the tree. It is found all over the tropical parts of the world, especially in the vicinity of the sea, growing within the reach of salt water, and establishing itself upon reefs and sand-banks as soon as they emerge from the ocean.* Its principal range is said by Mr. Marshall to be between the equator and the 25th parallel of latitude, and in the equinoctial zone it appears to extend to an altitude of about 2,900 feet above the sea level. Its great importance to man has caused it to be cultivated wherever the climate is favourable to its growth, and

* So partial does this palm appear to be to the presence of salt, that when cocoa nut trees are planted on the mainland of South America, or in the missions of the Orinoco, at a distance from the sea, a considerable quantity of salt, as much as half a bushel, is thrown into the hole that receives the nut.—*Humboldt's Personal Narrative.*

accordingly it is sometimes found occupying extensive tracts to the exclusion of all other trees. The whole Brazilian coast, from the river San Francisco to the bar of Mamanguape, a distance of 280 miles, is, with a few breaks, thus occupied; and it was estimated that, in 1813, no fewer than ten millions of cocoa nut trees were growing on the south-western coast of Ceylon, between Dondra Head and Calpentyn, which produced, in addition to a great quantity of cocoa nut oil, six thousand leaguers (900,000 gallons) of arrack, and upwards of three million pounds' weight of coir cordage.

There is a curious tradition in Ceylon, where the cocoa nut tree is not common in the interior, that once it did not exist there, but that its discovery was owing to a vision with which a rajah, or monarch of the country, was visited. The king was afflicted with a loathsome leprosy, which rendered his appearance scarcely human, (*elephantiasis*, probably,) and being very observant of the superstitious rites and ceremonies of the native Cingalese, he prayed and fasted according to the strictest injunctions of the priests, and at length fell into a trance. While in this state he beheld a vast expanse of water as far as the eye could reach, which, on tasting it, he found to be salt and nauseous, and on its

margin were large groves of a beautiful tree of great height, which was altogether new and strange to him. On awaking from his trance, he thought comparatively little of the vision, but renewed his oblations and prayers, and fell again into the same state as before. The vision was repeated, with the addition of the appearance of the father of the god Buddha, who rebuked him for his neglect of the former vision, and instructed him to take one hundred hours' journey to the south, at the termination of which he should find the tree which he had beheld, the fruit of which, attained by the aid of fire, should restore him to health. He was obedient to this mandate, performed the journey, found the trees, and viewed their lofty summits with amazement. He beheld the healing fruit suspended on high, but how to obtain them was the question. He bethought himself of the injunction of fire, and by rubbing two pieces of wood together obtained it, and by its aid so far burned through the trunk as easily to fell it. He lived entirely upon the nuts, in accordance with the injunctions he had received, and in three months' time he was cured. So runs the legend; and if we divest it of the superstitious and idolatrous details with which it is enveloped, the main facts are probably true.

The cocoa nut palm rises like a slender column to from sixty to ninety feet in height; its stem is of a soft, fibrous texture, and is marked externally by rings, produced by the fall of its leaves; two such leaves are said to drop off annually, and consequently the age of an individual is equal to half the number of annular scars on the stem. About a dozen or fifteen leaves, each from twelve to twenty-four feet long, and three feet broad, crown the summit of the stem; and as these are not unaptly compared to gigantic ostrich feathers, they give the plant the air of an enormous tuft of vegetable plumes. A reticulated substance, resembling coarse cloth, envelopes the base of each leaf stalk, but falls off before the leaf is full grown. The flowers proceed from within a large pointed spathe, which always opens on the underside. In wet seasons, the tree blossoms every five or six weeks, so that there are generally fresh flowers and ripe nuts on the tree at the same time. There are commonly from five to fifteen nuts in a bunch, and in a good soil a tree may bear from eight to twelve bunches, or from eighty to one hundred nuts annually. Mr. Stevens states, that five hundred nuts are often produced from a single tree. In the eyes of a native of Ceylon, the cocoa palm associates

itself with nearly every want and convenience of his life. It might tempt him to assert that if he were placed upon earth, with nothing whatever to minister to his temporal necessities but the cocoa nut tree, he could pass his days in content. "When the Cingalese villager has felled one of these trees, after it has done bearing, (say in its seventieth year,) with its trunk he builds his hut and his bullock stall, which he thatches with its leaves. His bolts and bars are slips of the bark, by which also he suspends the small shelf which holds his stock of home-made utensils and vessels. He fences his little plot of chillies, tobacco, and fine grain, with the leaf stalks. The infant is swung to sleep in a rude net of coir string, made from the husk of the fruit, and its meal of rice and scraped cocoa nut is boiled over a fire of cocoa nut shells and husks, and is eaten off a dish formed of the plaited green leaves of the tree, with a spoon cut out of the nut shell. When he goes a fishing by torch light, his net is of cocoa nut fibre; the torch, or *chule*, is a bundle of dried cocoa nut leaves and flower stalks; the little canoe is a trunk of the cocoa palm hollowed by his own hands. He carries home his net and his string of fish on a yoke, or *pingo*, formed of a cocoa nut stalk. When he is thirsty, he

drinks of the fresh juice of the young nut ; when he is hungry, he eats its soft kernel. If he has a mind to be merry, he sips a glass of arrack, distilled from the fermented juice of the palm, and dances to the music of rude cocoa nut castanets ; if he be weary, he quaffs 'toddy,' or the unfermented juice, and he flavours his curry with vinegar made from this toddy. Should he be sick, his body will be rubbed with cocoa nut oil ; he sweetens his coffee with jagghery, or cocoa nut sugar, and softens it with cocoa nut milk ; it is sipped by the light of a lamp constructed from a cocoa nut shell, and fed by cocoa nut oil. His doors, his windows, his shelves, his chairs, the water-gutter under the eaves, are all made from the wood of the tree. His spoons, his forks, his basins, his mugs, his salt cellars, his jars, his child's money-box, are all constructed from the shell of the nut. Over his couch when born, and over his grave when dead, a bunch of cocoa nut blossoms is hung to charm away evil spirits." Such is the account given us of the uses to which this palm and its products are applied by the natives of Ceylon, but a much longer catalogue must be made ere we shall number up the list of its useful applications, a few further items of which we may specify. The

root is chewed in place of the areca nut ; and by the native doctors is considered so efficacious in intermittent and remittent fevers, that it is almost invariably employed by them. Small pieces of it are boiled with dried ginger and jagghery, (palm sugar,) and the decoction is given to the patient at regular intervals. Gutters, drums, and posts, are formed from the trunk ; and the young terminal bud is a delicious esculent, whether fricasseed, pickled, or in its raw state, when it is as sweet and crisp as the Catappa almonds. It is said, however, that the trees die if it is removed. The leaves furnish a grateful shade when growing, and after separation from the tree, their vast size and hard texture render them invaluable as thatch for cottages ; they are moreover manufactured into baskets, buckets close enough to hold water, articles of head-dress, and even books on which writing is traced with an iron style. From the young leaves beautiful lanterns are made. They are excellent food for elephants, and are used by the natives to ornament their dwellings on festive occasions. Their ashes yield potash in abundance ; the mid-rib forms a capital oar ; and brushes are formed by bruising the end of a leaf with a portion of the mid-rib adhering to it. The woody ribs of the leaflets are used as

brooms, pins, toothpicks, and torches; other portions of the leaves form pens, and the sharp arrows which are blown from tubes by the Indians. Bristles of different kinds used as needles, and as a substitute for hair in brooms, are derived from the leaf-stalks. From the sap, collected about the time of flowering, a kind of palm wine is prepared, from which, when further fermented, an ardent spirit is distilled. The farina contained in the cellular portion of the stem is a good substitute for sago; and a coarse dark-coloured sugar, called jagghery, is obtained by evaporating the fresh sap. This jagghery, mixed with lime, forms a powerful cement, which resists moisture, endures great solar heat, and is used by the natives of Ceylon for the same purposes that we employ stucco. In this condition it is applied as flooring, and for the coating of columns; and as it will take a fine polish, it is often made to imitate marble. The juice of the flowers is of so astringent a nature, that it has the same effect as a solution of alum upon the inside of the mouth. Mixed with new milk, and taken in small quantities, it is employed as a medicine.

The liquor of the green cocoa nut is a delicious drink if it be plucked before sun-rise. The fresh ripe fruit is a wholesome food; its

pulp is an admirable vegetable blanc-mange, and the kernel of the seed cocoa nut, after vegetation has commenced, is reckoned among the delicacies of a Cingalese dessert. It is spongy, but pleasant to the taste, and is greatly esteemed by the natives. The *expressed* juice of the pulp of the ripe fruit is properly the milk, and is obtained by first rasping it with a kind of grater, then soaking it in water, and afterwards pressing it through a cloth, when it forms an ingredient in all good curries. The liquor which the nut contains is a grateful cooling beverage, and with the kernel constitutes the principal sustenance of the poorer Indians in many countries. In Ceylon, the cocoa nut contributes largely to the subsistence of the people; and when the grain crops fail, or are destroyed by inundations, avert much of the misery which so serious a calamity would otherwise occasion. They are largely imported into Europe as a luxury, and being used as wedges to set fast the casks and other round packages in the holds of vessels, their freight costs nothing. It was estimated a few years ago that six hundred thousand nuts were annually imported into England alone, chiefly from the West Indies. The husk in which the nut is enveloped is composed of strong fibre, and when this has been macerated

in water it is beaten out, and is then manufactured into an admirable kind of cordage and cable, very elastic, durable, and strong. It is now largely imported into this country under the name of "coir." Soaking in sea water is even said to improve it. The same material is largely employed as a stuffing for mattresses, being as elastic as horse-hair, and less friendly to the presence of vermin. It is also woven into different kinds of matting for lobbies and churches, which are surprisingly durable, resisting for a length of time the effects of the hardest wear.

The shell of the nut is manufactured into drinking vessels and measures, and the *albumen*, or white solid kernel contained within the shells, yields by pressure or decoction an excellent oil; the former is the method usually employed. It is largely employed by the natives of Ceylon for anointing the hair, which is remarked by travellers as generally luxuriant and beautiful, owing, as the Cingalese say, to the use of this article. It is also used for burning in lamps, for which it is well adapted, giving a good light, and being entirely free from any unpleasant smell. It is now very largely imported into this country for the manufacture of candles, which are made in the same

way as those from palm oil. It is also employed in the east for making torches, and in the composition of pharmaceutical preparations, and mixed with *dammar* (the resin of *Shorea robusta*) it forms the substance used in India for paying the seams of boats and ships. From the kernel of the nut a pleasant kind of cake is prepared, which is a good substitute for bread; puddings are also made of it. It is said that each cocoa nut is equivalent as food to at least three ounces of rice. A very interesting paper on the cocoa palm, by an eye-witness, appeared some months since in one of our periodicals, from which we cannot do better than extract a striking and graphic description of its mode of culture and its enemies:—

“This palm is assiduously cultivated in Ceylon in *topes*, or gardens; and it was long believed that the rude native system of culture was the best, but experience has shown the fallacy of this opinion. Hence the Cingalese continue to find the manual labour, but the Englishman provides skill and implements. The dry ditch and thorny fence that form the boundary and protection of the estate were at last reached, and the little gate and watch-hut were passed. The watcher, or *sascoryn*, was a Malay, moustached and fierce; for the

natives of the country can rarely be depended on as protectors of property against their fellow-villagers. A narrow belt of jungle, trees, and shrubs, had been left quite round the plantation, to assist in keeping out cattle and wild animals, which are frequently very destructive to a young cocoa nut estate, in spite of armed watchers, ditches, and fences. Passing through this belt, I found, on entering, an entirely new scene; before and around me waved gracefully the long, shining leaves of three hundred acres of cocoa palms, each acre containing, on an average, eighty palms. It was indeed a beautiful and interesting sight. Two-thirds of these trees were yielding ample crops, though only in their ninth year; in two years more they will generally be in full bearing. Unlike the rudely planted native garden, this estate had been most carefully laid down; the young plants had all been placed out at regular intervals, and in perfectly straight lines; so that looking over the estate in either direction the long avenues presented one unbroken figure, at once pleasing to the eye and easy of access. But if these interminable masses of palms appeared a lovely picture when regarded at some distance, how much was their beauty heightened on a nearer inspection. Walking

close under the shadow of their long and ribbon-like leaves, I could see how thickly they were studded with golden green fruit in every stage of growth. The sight was absolutely marvellous. Were such trees, so laden, painted by an artist, his production would, in all probability, be pronounced unnatural. They appeared more like some fairy creations, got up for my especial amusement, resembling nearly those gorgeous trees which, in my youth, I delighted to read about in the 'Arabian Nights,' growing in subterranean gardens, and yielding precious stones. They hung in grape-like clusters around the crest of the tree; the large golden ripe nuts below, smaller and greener fruit just above them, followed by scores of others in all stages, from the blossom seed to the half-grown; it was impossible to catch a glimpse of the stem, so thickly did the fruit hang on all sides. I made an attempt to count them—'thirty, fifty, eighty, a hundred,'—I could go no further; those little fellows near the top, peeping up like so many tiny dolls' heads, defied my most careful numerations; but I feel confident there must have been quite two hundred nuts on that one palm. Above the clusters of rich fruit, were two feather-like flowers, white as snow, and smooth and glossy

as polished marble ; they had just burst from their sheaths ; and a more delicate, lovely picture could scarcely be imagined. A cocoa nut tree in a native Cingalese tope will sometimes yield fifty nuts in twelve months ; but the average of them seldom give more than twenty-five in a year. It is, therefore, very evident that European skill may be employed beneficially on this cultivation, as well as on any other.

“ I was at first rather startled at perceiving a tall, half-naked Cingalese away in the distance, with a gun at least half as long again as himself, long black hair over his shoulders, and bunches of something hanging at his girdle. He was watching some game amongst the trees ; at last he fired, ran, and picked up something and stuck it in his girdle. What could it be ? Parrot, pigeon, or jungle fowl ? It was only a poor little squirrel ; and there were at least two scores of these pretty creatures hanging at the waist of the mighty hunter ! Fortunately I could speak the native language, and was not long in learning the cause of this slaughter. It appeared that in addition to their pretty bushy tail, glossy coats, and playful gambols, the squirrels have very sharp and active teeth, and an uncommon relish for the sweet, tender

buds of the cocoa nut flower, which they nip off and destroy by scores, and of course lessen by so much the future crop of fruit. Handsful of the buds lay half-eaten around each tree, and I no longer felt astonished at this species of sporting.

“ The ground had evidently been well cleared from jungle plants, not one of which was to be seen in all this tract ; a stout and healthy looking grass was springing up along the avenues, whilst at certain intervals patches of Indian corn, sweet potatoes, guinea-grass, and other products, intended for cattle fodder during dry months when the wild grasses fail—gave tints of varied luxuriance to the scene. The ground at this part of the estate sloped a little, and I came to an open space somewhat marshy in appearance. A number of cattle, young and old, were browsing about on the long grass, or sipping a draught from the clear stream which ran through the low ground. They were confined within a rude but stout fence, and on one side was a range of low sheds for their shelter. The cattle appeared in good condition ; they were purchased when very young from the drovers, who bring them in hundreds from the Malabar coast, and many were then fit for the cart, the carriage, or the knife. At the end

was a manure shed, and outside stood a keeper's hut, with a store attached, in which were piled up dried guinea grass, maize, etc. The manure pit was deep and large, and in *it* lay the true secret of the magical productiveness of the trees I had just seen. Good seed, planted in light free soil, well cleared and drained, will produce a fine healthy tree in a few years; and if to this be added occasional supplies of manure, and a few waterings during the dry season, an abundant yield of fruit will most assuredly reward the toil and outlay of the cocoa nut cultivator.

“Leaving this spot, I strolled into the next field, to see what a number of little boys were so busy about. There were a dozen black urchins, running about from tree to tree; sometimes they stopped, clambered up, and appeared to have very particular business to transact at the stems of the leaves; but oftener they passed on, contented with a mere glance upwards at the fruit. They had a sharp-pointed instrument in the hand, whilst at the wrist of each was hung a cocoa nut shell. I paused to see what one of these children was searching for, half hid as the little fellow was amongst the gigantic leaves. Intently scrutinizing his motions, I observed that he forced the little sharp instrument into the very body of the tree;

down it went into the inmost core of the giant stem; all his strength was employed; he strained and struggled among the huge leaves as though he was engaged in deadly strife with some terrible boa, or chutah. At last he secured his antagonist, and descended with something alive, small and black, and impaled on the barbed point of his little weapon. A few questions elicited the whole secret. The cocoa nut tree, it seems, has many enemies besides squirrels; the elephant, the wild hog, the rat, the white ant, the porcupine, the monkey, and a large white worm, either attack it while young, or rob it of its fruit when mature. But the most numerous and persevering enemy which it has to encounter, from the age of three years till long after it produces fruit, is the *cooroominya*, or cocoa nut beetle, a black, hard-coated creature, with beautiful wings, and a most powerful little tusk, which it employs with fatal activity to open a way into the trunks of the palms. Its labours commence in the evening, and by early morning it will be buried half-a-dozen inches deep in the very centre of the tree, where, if not detected and removed, it feeds on the soft pithy fibres, deposits its eggs, and does not depart in less than two or three days. These holes are always made in the

sweetest and softest part of the tree, near the crown ; and in young plants they prove seriously hurtful, checking the growth, and impairing the health of the future tree. In a morning's walk, an active lad will frequently secure as many as a score of these cooroominyas, which, after being killed, are strung up on Lilliputian gibbets about the estate, as a warning to their live friends.

“Further on, I perceived, gathered in anxious consultation, three of the lads around a tree that was loaded with fruit ; they looked up at the leaves, then at the root, then at the trunk. At last, one little fellow started off, swift-footed as a hare, and was soon out of sight. The others began scraping the earth from the root as fast as possible ; and all the information they would impart was ‘*leydie gaha*,’ or sick tree, so that there was nothing for it but to imagine that the little messenger had been despatched for the doctor. He soon came back, not with the medicine man, but a *mamootie*, or Dutch hoe, and a *cattie*, or sharp bill-hook, and then the busy work went on again. In little more time than I take to tell the story, the soil was removed from about the root, a hole was discovered in the trunk, and its course upwards ascertained by means of a cane probe. With

the cattie, one of the boys commenced cutting an opening midway in the trunk of the tree. On looking up, I perceived that the patient gave unmistakable signs of ill-health. The long leaves were drooping at the end, and tinged with a sickly yellow; many of the nuts had fallen off, and others had evidently half a mind to follow the example. The flower which had just burst above hung down its sickly head, and was weeping away the germs of what had else been nuts. The hole was now complete; it was large enough for the smallest boy to force his hand in, and it soon brought away a basket-full of pith and powdered wood from the body of the tree. There, amidst the ruin, was the enemy that had caused so much mischief and labour. It was an unsightly worm, about four inches in length, and as thick as one's small finger, having a dull white body and black head. I then began to wonder what had next to be done; whether the tree would die after all this hacking and maiming. Would the medicine man now be sent for?—no. The interior of the wounded tree as well as the aperture was thoroughly freed from dirt, and any decomposed fibre which might have aided in hatching eggs left by the worm—and finally the root was covered up, and the opening and

inside of the palm tightly filled with clay. I was assured that not more than one of ten trees, thus treated, ever fails to recover its health. The nocturnal attacks of elephants are checked by means of lighted fires, and an occasional shot or two during the night. Wild hogs and porcupines are caught in traps and hunted by dogs. The monkeys, like the squirrels and the white ants, are poisoned. In spite of all these measures, however, an estate often suffers severely, and its productiveness is much interfered with by these many depredators.

“The soil over which I had as yet passed had been of one uniform description, a light sandy earth, containing a little vegetable matter, and but a little. Afterwards, I arrived at a tract of planted land, quite different in its nature and mode of cultivation. It was of a far stiffer character, deeper in colour and more weedy. This portion of the estate was in former days a swamp, in which the porcupine, the wild hog, and the jackal delighted to dwell, sheltered from the encroachment of man by a dense mass of low jungle, thorns, and reeds. To drive away these destructive creatures from the vicinity of the young palms, the jungle was fired during the dry weather. It was then perceived that the soil of this morass, although

wet and rank from its position, was of a most luxuriant character; a few deep drains were opened through the centre, cross drains were cut, and after one season's exposure to the purifying action of the atmosphere and rain, the whole of it was planted, and it now gives fair promise of being one day the finest field in the plantation.

“From this low ground I strolled through some long avenues on the right; their long leaves protected me from the heat of the afternoon sun, which was still considerable. The trees on this side were evidently older; they had a greater number of ripe fruit; and further away in the distance might be seen a multitude of men and boys, busily engaged in bearing away the huge nuts in pairs to a path, or rude cart-track, where a *cangany*, or native overseer, was occupied in counting them as they were tossed into the bullock cart. The expertness of the boys in climbing these smooth, broken, and branchless trees, by the aid of a small band formed by twisting a portion of a cocoa nut leaf, was truly astonishing. In a moment, their small feet grasped the trunk, aided by a twisted leaf, whilst their hands were employed above; they glided upwards, and with a quick eye detected the riper fruit, which, rapidly twisted

from their stalks, were flung to the ground. Their companions below were busy removing the nuts, which for young children is no easy task, the nuts frequently weighing fifteen or twenty pounds each, with the husk or outer skin on them. The natives have a simple but ingenious method of tying them together in pairs, by which means boys can carry two of them with ease, when otherwise one would be a task of difficulty. The nuts have little, if any, stalk; the practice, therefore, is to slit up a portion of the husk, (which is the coir fibre in its natural state,) pull out a sufficient length without breaking it, and thus tie two together; in this way, the little urchins scamper along with the nuts slung across their shoulders, scarcely feeling the weight.

“I followed the loaded carts. They were halted at a large inclosure, inside of which were huge pens formed of jungle sticks, about ten feet in height; into these the nuts were stored and recounted; a certain number only being kept in each, as the pens are all of the same dimensions. Adjoining was another and still larger space, lying lower, with some deep ditches and pits in the midst. Here the outer husk is stripped off, preparatory to breaking the nut itself in order to obtain the kernel, which has

to be dried before the oil can be expressed. Into the pits or ditches the husk is flung, and left in water for ten or fourteen days, when it is removed, and beaten out on stones, to free the woody elastic fibre from dirt and useless vegetable matter. This is a most disagreeable operation, for the stench from the half putrid husks is very strong. The fibre, after being well dried on the sandy ground, undergoes a rude assortment into three qualities, in reference chiefly to colour, and is then delivered over to the ropemaker, who works it up into yarn, rope, or junk, as required. Freed from their outer covering, the nuts are either sold for making curries, in which they form a prominent feature, or they are kept for drying ready for the oil mill.

“Having learned this much, I strolled through the neat small field, and along a patch of guinea grass, to see what was going on in that direction. The neat-looking building adjoining was the superintendent’s bungalow; and the long sheds and open spaces in their front and rear were for drying the nuts into what is called *copperah*, in which state they are ground up for pressure. It was a busy scene, indeed, and the operations require constant vigilance on the part of the manager; yet all the work is car-

ried on in the rudest way, and with the most simple implements. Half-a-dozen stout lads were seated, cross-legged, on the ground, each with a heap of nuts by his side. The rapidity with which they seized these, and with one sharp blow of a heavy knife split them precisely in half, and flung them away into other heaps, was remarkable. It seemed to be done with scarcely an effort; yet, on handling the broken nut, one cannot help being struck with its thickness and strength. Smaller boys were busily employed in removing these heaps of split fruit to the large open spaces, where others, assisted by a few women, were occupied in placing them in rows close together with the open part upwards, so that the kernels may be fully exposed to the direct rays of the sun. In this way they remain for two days, when the fruit, partly dried, shrinks from the shell, and is removed. Two more days' exposure to the sun in fine weather will generally complete the drying process. The kernels are then called copperah, and are brittle and unctuous in the hand.

“To convert this material into oil, the natives employ a very primitive mill, worked by bullocks, and called a checkoo; this process is very slow, and the oil never clean. Europeans have, however, obviated these objections, and

manufactured the cocoa nut oil by means of granite crushers and hydraulic presses worked by steam power. This is only done in Columbo, to which place, of course, the copperah has to be conveyed. The refuse of the oil presses—the dry cake, or *poonac*, is very useful as food for cattle and poultry, and not less so as a manure for the palm trees, when moistened and applied in a partially decomposed state. All these operations are not carried on with ease and regularity. The Cingalese are an idle race; like many better men, their chief pleasure is to perform as little work as possible. This necessitates a never-ending round of inspection by the European manager, who, mounted on a small pony, paper umbrella in hand, visits every corner of the property at least once in the day, often twice. Neither is it unusual for him to make a round during the night. On the whole, then, he enjoys no sinecure. The manufacture of arrack is entirely in the hands of the natives, who employ stills of the rudest construction; the permission to retail arrack and toddy is annually farmed out by the Ceylon government; the renters are natives, who frequently pay as much as £60,000 annually for the monopoly, about one-eighth part of the entire revenues of the island.

“If we consider the very light and poor nature of the soil in which cocoa nut cultivation is carried on, it cannot but be matter for wonder that these trees attain so large a size, and yield such bulky and continuous crops during so many years. Not unfrequently they reach a height of sixty feet, and yield fully fifty nuts each tree per annum, gathered in alternate months, and continue in bearing for seventy, and sometimes for ninety years. A calculation, based on these data, shows that an acre of yellow sandy soil will produce, without the aid of manure, a weight of fourteen and a quarter tons in green fruit, and seven tons of leaves, annually. To yield this once or twice may not seem deserving of much wonder, but that this production should continue for half a century without any renovation of soil, and only accidental supplies of manure, cannot but be considered a remarkable instance of the unaided fertilizing powers of nature.”

We have already stated that *toddy* is extracted from the cocoa nut tree. It is the sweet juice or sap of the tree at the time of flowering, and is also termed palm wine. It may be obtained from many other palms as well as the cocoa nut, but in Ceylon the latter is almost exclusively employed for the purpose. We will, therefore,

detail the process of toddy drawing as practised there. The extraction of this juice is performed by regular professional operators, who are called "toddy drawers." We have said that the trees are cultivated in "*topes*," that is, orchards or plantations. When it is intended to draw toddy from a *tope*, the toddy drawer selects a tree of easy ascent, near the centre of the plantation, the stem of which he surrounds with a number of bands, made of creepers, about a foot distant from each other. Upon these bands he ascends the tree; and by means of the stems of creeping plants or coir ropes, he proceeds tightly to connect together the heads of a number of trees. Along these ropes he can then pass readily from tree to tree, without having to ascend them each separately. The ordinary implements of the toddy drawer are, a large broad knife, which he carries in a basket hung on a cord which is tied round him; a mallet, consisting of a piece of hard wood about twelve inches long; and the shell of a large gourd, which is also suspended from his waist. When a tree is in a fit state for yielding sweet juice, the toddy drawer ties the flowering spathe in different places by means of the white leaflets of the young leaves. This process has the effect of preventing a bud from expanding. The spathe

is then bruised along its whole length by means of slight blows with the bat of hard wood. This operation occupies a few minutes, and requires to be regularly repeated every morning and evening for six or seven days. In a few days after the spathe has been tied, a few inches of it are cut off by means of the broad knife. From the wound, sweet juice begins to distil in two or three days, and is received in an earthenware vessel attached to the spathe. The liquor issues drop by drop, and a good healthy blossom will yield from two to four English pints in twenty-four hours, and continue to afford that quantity for a period varying from three to five weeks. As the cocoa nut tree blossoms every four or five weeks, two spathes on one tree will sometimes be yielding sweet juice at the same time. The toddy drawer generally ascends the trees for the purpose of collecting the sweet juice that has exuded into the toddy pots, both morning and evening, and to cut off a fresh portion of the flowering spathe. The toddy is poured from the earthen vessels into the gourd, which, when full, is conveyed to the ground by means of a line. The gourd is emptied into a large vessel by a person at the foot of the tree, and is then drawn up by the toddy drawer for the purpose of being refilled. When fresh, it

forms a cool and inexpressibly grateful beverage to him who (as Darwin says) can sit beneath the broad shadow of the palm, and quench his thirst with its delightful produce. This same juice, when fermentation has taken place, which naturally occurs in those torrid climes in a few hours, yields by distillation a spirituous liquor termed "arrack," and which, from its cheapness and the ease with which it is obtained, is one of the most seducing and pernicious of intoxicating liquors, and is the ruin of European soldiers in India. The fermented toddy is frequently distilled on the same day that it is drawn, but sometimes the operation is delayed till it has become sour. The process of distillation is carried on in the maritime provinces in copper stills, but in the interior of the island earthen vessels are chiefly employed. Toddy yields by distillation one-eighth part of proof spirit. Ceylon exports annually from 750,000 to 900,000 gallons of arrack, chiefly to the presidencies of Bengal, Madras, and Bombay, at the value of eightpence to tenpence per gallon. What a mournful and depraved feature is it in our fallen nature, to turn blessings into curses—to pervert those gifts of God which are designed for the good of man into means of bringing disease, misery, and death upon him!

We have, perhaps, no more striking instance of such perversion than in the case of the cocoa nut, certainly one of the most extensively useful of all the vegetable tribes, yet rendered most pernicious in its abuse for the production of a hurtful intoxicating drink. And not only in regard to temporal things does man thus abuse the Divine mercies, but God's greatest and best gift—when he “spared not his own Son, but delivered him up for us all”—even this wonderful gift, intended for their salvation, do men pervert to their own destruction; for “this is the condemnation, that light is come into the world, and men loved darkness rather than light, because their deeds were evil.”

Phœnix sylvestris, a species allied to the date palm, is one of the most common palms of India, especially in its more arid portions. It is called *Khujjoo* by the natives, and the date tree by Europeans, from its resemblance in appearance to the true date palm. It has a tall, pretty thick trunk, and large yellowish or reddish fruit. Its principal use is for the palm wine or toddy, which it yields, and in the production of which it has perhaps the greatest share of any in our Indian possessions. The mode of obtaining it is by removing the lower leaves and their sheaths, and cutting a notch

into the centre of the tree near the top, from which the liquor issues, and is conducted by a small channel, made of a bit of palmyra tree leaf, into a pot suspended to receive it. This juice is either drunk fresh from the tree, or boiled down into sugar, or fermented for distillation, when it gives out a large portion of the spirit called "paria arrack." At the age of seven to ten years, when the trunk is about four feet high, it begins to yield juice, and continues productive for twenty or twenty-five years. The juice is extracted during the months of November, December, January, and February, during which period each tree is reckoned to yield from 120 to 240 pints. The fluid is obtained chiefly during the night, and is afterwards boiled down before fermentation takes place. The thick syrup thus procured is mixed with sand and stones to the amount of ten or fifteen per cent. to make it more solid, portable, and heavy. Every twelve pints of the juice is boiled down to one of *goor*, or *jagghery*, and four pounds of jagghery yield one of good sugar in powder, so that the average produce of each tree is seven or eight pounds of sugar annually.* Jagghery is

* This is Dr. Royle's statement, ("Illustrations of Himalayan Botany,") and is reiterated by Dr. Lindley; but there

darker coloured than the darkest muscovado sugar; it is granular or moist, and is packed in mats or bags made of palm leaves. Sugar has long been made in India from this species, and is obtained by the following process:—The jaggery is refined by dissolving it in water over a fire, at the same time mixing *alunam* (lime made from sea-shells) with it to check fermentation; after this it is strained through a filter of animal charcoal, again boiled and strained through cotton bags. For the purpose of clarifying, eggs and *chunam* are used. When the syrup is of a proper consistence, it is put into wooden or earthen coolers, and the molasses allowed to drain off. To whiten it as much as possible, rum, or sometimes a fine syrup, is poured over the sugar whilst in the coolers; it is then exposed to the sun to dry, and lastly, packed in bags for exportation. As imported into this country it belongs to the class of white or refined sugars. It is yellowish white, and has the texture and flavour of refined cane sugars. It is manufactured chiefly at Cuddalore, on the Coromandel coast, by five different houses, the chief of which is that of

would seem to be some error. According to this statement, 340 to 380 pints of juice would be needed to produce seven or eight pounds of sugar.

Viney and Cardoza, of Pondicherry. It has been stated that palm sugar is deficient in what is technically called *strength*; that is, when refined, it forms a sugar which crumbles in drying. Hence these sugars are sold as imported to grocers for mixing; they do not pay for refining. It is the opinion of some, however, who are well qualified to judge, that palm sugar will eventually, to a great extent, supersede cane sugar. It can be manufactured at less cost, and the palms affording it grow in abundance in all parts of the tropics, in a dry sandy soil which would produce nothing else of value. They require very little cultivation, merely enough to keep the luxuriant vegetation from springing up into a jungle around them, and to remove the numerous parasitical plants from their stems. Of course the sugar will improve in quality when more experience has been gained in the way of making it, the oldest factory having been established only a few years. The quantity produced in 1844 was more than six thousand tons. Besides the *Phœnix sylvestris*, the sap of other palms is employed in making jaggery, the most important of which are, *Borassus flabelliformis*, *Arenga saccharifera*, and the cocoa nut, and lesser fan palms.

Phoenix furinifera is a dwarf species of the same genus as the last, and grows on dry ground or sandy hills, not far from the sea, on the Coromandel coast. It is a very low tree, or rather great leafy bush, for the trunk is never above one-and-a-half or two feet high, and the leaves completely conceal it. It is of a much deeper green and has much narrower leaflets than those of the date. It fruits and flowers much in the same manner. The berries are about the size of kidney beans, and are black and shining; they have not much pulp, but what there is is sweet and mealy. It flowers in January and February, and the fruit ripens in May. The leaflets are wrought into mats for sleeping on, and the main leaf stalks are split lengthwise into three or four pieces, and are used for making baskets. This is one of the sago palms. It contains in the cellular tissue of its small trunk a large quantity of a farinaceous substance, or sago starch, which the natives use for food in time of scarcity; but being of inferior quality to that yielded by other palms, and withal bitterish in taste, it is seldom met with in commerce. To obtain it the small trunk is split into six or eight pieces, and dried; then beaten in wooden mortars till the farinaceous part is detached from the fibres;

it is then sifted to separate them ; the meal is then fit for use. The only further preparation which this meal undergoes is the boiling it into a thick gruel, or *canji*. It seems to possess less nutriment than common sago, and is less palatable when boiled, but it has saved many lives in time of scarcity.

Corypha talliera is another of the palms of the East Indies. It is called *tara*, or *talliera*, by the natives of Bengal, where it is abundant. It is an elegant and stately species, with a trunk about thirty feet high, and as nearly as possible of equal thickness throughout. Its gigantic fan-shaped leaves are each composed of eighty leaflets, each of which is six feet long and four inches broad ; and the leaf stalk, from the point of which they radiate, is from five to ten feet long, and fringed at its edge with strong sharp thorns. The flowers burst from the spathe in the month of February, and rise from the apex of the stem and the centre of the leaves in an immense, spreading, oval bunch, or panicle, twenty or more feet in height. The fruit is about the size of a crab apple, wrinkled, dark olive or greenish yellow. The leaves are used by the natives of India to write upon with their steel styles, and for other purposes.

Corypha umbraculifera is another species of

the same genus, far more generally known than the last. It is called by the natives of Ceylon, where it chiefly grows, the tala, or talipat palm. It also occurs in the Burmese empire, and in other parts of India. Its general appearance is somewhat similar to the last, but it is altogether a nobler tree, and more stately in stature and appearance, as well as of more importance in its economical applications. It varies in height from sixty to about two hundred feet. The stem is perfectly straight, from six to ten feet in circumference, and tapers towards the upper part, which is not above half the diameter of the base, while it is firm and strong enough to resist the most violent tropical winds. The leaves, like those of the *C. talliera*, are fan-shaped, and almost circular, their length being about eighteen feet, and their diameter about fourteen feet. Mr. Bennett, author of a curious work on the fishes of Ceylon, brought home a leaf of this tree thirty-six feet in circumference. The prodigious size of the leaf will be better understood when it is stated that ten or twelve (Knox says fifteen to twenty) men can be completely sheltered beneath one of them; while, on the rivers of Ceylon, both the freight and crew on the rafts are often covered entirely by a single leaf, forming a complete canopy above

them. The crown of leaves at the head of the tree is more than forty feet in diameter. The flowers emerge as in the last species, and are clustered on a pyramidally branched spadix, which rises to a great height, often as much as thirty feet above the top of the stem. They are at first of a bright yellow colour, exceedingly beautiful to the eye, but emitting an odour too strong and pungent to be pleasant. Before its development, the bunch of flowers is inclosed in a hard rind or spathe, which, upon their expansion, bursts with a loud explosion. The talipat palm blossoms but once during its existence, and that not until it has reached an advanced age—according to the natives, one hundred years. Ribeyro, a Portuguese writer, says in about thirty years, which is more likely to be correct. As soon as the blossoms have withered and the fruit ripened, which occupies fifteen or twenty months, the tree dries up and decays so rapidly, that in two or three weeks it is seen prostrate and rotting on the ground. Thus, in dying, like the fabled Phœnix of the ancients, it provides for the renewal of its kind from its ashes. The fruits or seeds are as large as cherries, and exceedingly numerous, but not eatable; they are only useful as seeds to reproduce and multiply the tree. It appears that

the natives do not sow them, but leave that operation entirely to nature.

Knox asserts, that if the tree be cut down before it runs to seed, the farina, largely contained within the stem, is nutritious and wholesome ; and adds, that “ the natives take the pith and beat it in mortars to flour, and bake cakes of it, which taste much like wheat bread ; and it serves them instead of corn before their harvest be ripe.” A better known fact about the uses of the inner parts of the tree is that sago is made from them. By beating the spongy portion of the stem in a mortar, and afterwards sifting, the fecula, or sago flour, is readily separated. It is, however, mainly used by the natives, and does not form any, or at least a very small portion, of the sago of commerce. The great value, however, of this noble tree resides in its leaves. Growing on the tree, they are, when expanded, of a beautiful dark green colour ; but those chiefly used are cut before they are spread out, and have, and retain for ages, a pale brownish yellow colour, not unlike old parchment. Their preparation for use is very simple. They are rubbed with hard, smooth pieces of wood, which express any moisture that may remain, and increase their pliability, which is naturally very great. They are used

as fans by the natives of Ceylon, for they can be opened or closed like a fan, and almost with as little exertion. The talipat leaf is, too, their only umbrella and parasol, and it forms their only tent when in the field. It is so light that an entire one can be carried in the hand ; but as this, from its great size when expanded, would be inconvenient, the natives cut sections of it, which they use to defend themselves from the scorching rays of the sun, or from the rain. No handles are used, but the two sides of the leaf are grasped by the bearer. Their ribs are of the texture of cane, which adds greatly to their strength ; and when cut at the extremity of the leaf stalks, they are said to be used to protect the heads of travellers and fighting men, who have to force their way through the jungle. For this purpose only a portion of the leaf is used ; the thickest part, which was attached to the leaf stalk, is placed forwards, and the sides hanging over the ears, a kind of wedge, or inverted keel, is formed, which forces the branches aside as the wearer pushes on.

Knox says of this leaf, that “ being dried it is very strong and limber, and most wonderfully made for men’s convenience to carry along with them ; for though it be thus broad when

open, yet it folds close like a lady's fan, and then is no bigger than a man's arm, and extremely light. This is a marvellous mercy, which Almighty God hath bestowed upon this poor and naked people in this rainy country." He ought to have added, "in this *hot country*," for the heats of Ceylon, whose mean temperature is 81° , are frequently, and for long periods, very great; and the talipat leaf is quite as valuable a protection against them as against rain. However much water may fall on the leaf, it imbibes no humidity, remaining dry and light as ever. The British troops, in their campaign in the jungles against the Cingalese, in 1817 and 1818, found to their cost how excellent a preservation it was against wet and damp. The enemy's musket men were furnished each with a talipat leaf, by means of which they always kept their arms and powder perfectly dry, and could fire upon the invading forces; while frequently the British muskets, which had no such protection, were rendered useless by the heavy rains, and the moisture of the woods and thickets, and the soldiery were consequently unable to return the fire of the natives. For tents, the talipat leaves are set up on end. Two or three talipat umbrellas thus employed make an excellent shelter, and

from being so light and portable, they are admirably adapted for this important service. The chiefs, moreover, have regularly-formed square tents made of them. In these the leaves are neatly sewed together, and laid over a light framework, so that the whole is of trifling weight, and can be packed up in a very small compass. Another important use to which these leaves are applied is as a substitute for paper; indeed, they may be called "Ceylon paper," for almost, if not quite, all Cingalese writings are executed on this or a similar material. The leaves are for this purpose cut into strips, usually about fifteen inches long by three broad. These pieces are soaked for a short time in boiling water or milk, then rubbed backwards and forwards over a smooth piece of wood to make them pliable, and then carefully dried. They will then readily receive and retain an impression from a pointed instrument; and the Cingalese accordingly write or engrave their letters upon them with such an implement, which is called a style, and is usually made of brass, steel, or iron. After the leaf is written on, it is rubbed over with a dark-coloured substance, which only remaining in the part etched or scratched, gives the characters greater relief, and makes them more

easy to read. The colouring matter is rendered liquid by being mixed with cocoa nut oil, and when dry is not easily effaced. On common occasions, the Cingalese write on the leaf of another species of palm, but the talipat is used in all government despatches, important documents, such as title-deeds of estates, etc., and in their books. A Cingalese book is a bundle of these strips tied together. Some of these books in sir A. Johnstone's collection are supposed to be between five hundred and six hundred years old, and are still very perfect. Two fine specimens of books written upon the leaves, now in the library of the Royal Asiatic Society, are considered invaluable. As even the lawyers and the learned in Ceylon are very deficient in chronological knowledge, great confusion sometimes occurs as to dates; and it is very common to see a Cingalese judge attempting to ascertain the antiquity of a document by smelling and cutting it.

The oil employed in the writing imparts a strong odour, which preserves it from insects; but this odour is changed by age. The talipat, however, appears to have in itself a natural quality which deters the attacks of insects, and preserves it from the decay of old age even without the oil. We may also mention that

the Cingalese, who engrave the most solemn of their deeds, such as the foundation of, or donations to, a temple, on plates of fine copper, which are generally neatly edged with silver, always made these plates precisely the same shape as the talipat strip used for writing. Besides the uses that have been enumerated, the Cingalese employ the talipat leaf extensively in thatching their houses. They also manufacture hats from it. These hats are made with brims as broad as an outstretched umbrella, and are chiefly worn by women nursing to defend them and their infants from the heat. The talipat tree is not very common at present in Ceylon, and is rarely seen growing by those who only visit the coasts of the island, and do not penetrate the interior. It seems to grow scattered among the other trees in the forests.

Corypha gebanga is a third species of this genus, which is of important service to the inhabitants of Java. Thousands of boys and girls are employed in that country in weaving its young leaves into baskets and bags. A kind of sago is extracted from the soft central portion of the stem in the same manner as from *Phoenix farinifera* and the talipat; and its leaves are employed like those of the last named, as thatch for cottages and for making broad-brimmed hats.

Fishing-nets and linen shirts are woven from its fibres, and ropes from its twisted leaf stalks. The root is a useful medicine, and possesses emollient and slightly astringent properties; sliced, it is used in slight diarrhœas; and Waitz even says that it is a most valuable remedy for the periodical diarrhœas which in the East Indies so frequently attack Europeans out of health.

Areca catechu, the *areca*, or *betel* palm, is described by Dr. Roxburgh as the most beautiful palm in India. It has a remarkably straight trunk, which rises to a height of from forty to fifty feet, is six or eight inches in diameter, of an equal thickness throughout, and with a smooth ash-coloured surface, marked with parallel rings. The leaves, of which there are only six or seven, spring from the top, and are six feet in length, gracefully curving downwards from a long stalk. This palm is cultivated all over India for the sake of its nuts and fruit, which are of the size and shape of a hen's egg, and much resemble a nutmeg deprived of its husk. The nut is enveloped in a firm fibrous rind, about half an inch thick. When ripe, the fruit is of a reddish yellow colour, and hangs in rich clusters, forming a beautiful contrast with the bright green of its leaves. If allowed to remain long enough, it falls off and

sows itself in the ground; but this is not usually suffered. The fruit is gathered, and after undergoing certain preparatory processes, is the *pinang*, or betel nut, so universally chewed in the East Indies. The fresh nut cannot be eaten, because it contains in its crude state a white viscous matter, which, though insipid to the taste, occasions delirium, and it is therefore subjected to processes, the aim of which is to dissipate the deleterious principle.

The cultivation of the areca palm is carried on in gardens or plantations on an extensive scale. The soil most favourable to it is a black mould on a substratum of limestone, or intermixed with calcareous nodules. It is propagated from the ripest seeds or fruits, which are first sown in beds, and afterwards removed to their *places* in *plantations*. It is *planted* in rows, and carefully manured and watered during several years. These *plantations* are usually close to the villages, and are highly ornamental. The neighbourhood of the sea is conducive to the perfection of the fruit; and the warmer and lower the land, the more rapidly does the tree advance to maturity. It begins to bear from the fifth or sixth to the fifteenth year, and remains in perfection for thirty years longer. Some individuals, how-

ever, produce fruit up to the seventieth, or even the hundredth year, but the produce declines both in quality and quantity. It is stated that every fertile tree produces on an average eight hundred and fifty nuts annually, and an ordinary tree as many as six hundred, but this is by no means a general rule, for some trees produce only about two hundred nuts. The average produce, says Crawford, may be stated at not less than fourteen pounds' weight, and as these palms are usually planted at a distance of seven and a half feet, it follows that the produce of an acre is 10,841 pounds. This explains the extraordinary cheapness at which the grower is enabled to sell the nut, which is often as low as half a dollar per picul of 133½ pounds. It was stated some years ago, that the number of betel palms in Prince of Wales's Island alone amounted to 342,110; and many ships freighted solely with the nuts sail annually from the ports of Sumatra, Malacca, Siam, and Cochin-China.

The crop of the areca is produced during three months, and the nuts when gathered are each cut into seven or eight pieces and piled in a heap. They are then boiled in water which has been previously mixed with a decoction of areca nut, betel-leaf, *Terra japonica*, and *Mimosa indica*. They are then dried, and by this pro-

cess the pernicious quality alluded to above is removed. The nut thus prepared forms one of the ingredients of *betel*, or *pawn*, as it is called in Bengal, which is universally chewed by the inhabitants of tropical Asia for its stimulating and inebriating properties. In South America, the cocoa and mambee are thus used, and, in many parts of the world, tobacco is employed in the same way. But neither of these is in half such general use as the betel in the east. All persons, without exception of age or sex, begin at an early age to accustom themselves to the use of betel, until it becomes an article of absolute necessity. Blume tells us that the Asiatic nations would rather forego meat and drink than their favourite areca nut; and even Europeans who have resided long among the betel chewers acquire the habit, and enjoy it quite as much as the natives.

Betel consists always of three ingredients; a piece of the nut of the areca palm, folded in a leaf of a species of pepper called betel, smeared with a little *chunam*, or lime made from burnt shells: and sometimes a fourth is added, *Terra japonica*, or catechu. The *betel* plant is the *Piper betel*, a climbing plant with ivy-like leaves, and nearly allied to the species which produces black pepper. It is carefully

cultivated, and is trained upon poles; or very often plantains or bamboos are planted with the betel plants, so that as the former grow upwards the pepper vine may twist around them, and cling to them for support; or when a plantation of areca palms is about fifteen years old, betel cuttings are planted near the root, and trained up to the trees. In twelve or eighteen months the leaves are fit for use, and in three years they have attained their full size; in the fourth year they die, and new plants must be substituted. In eighteen or twenty years the soil is considered exhausted. The palm and pepper gardens are always inclosed by a strong hedge, but squirrels and even elephants do great mischief, and often entail heavy losses on the cultivators.

The union of the three ingredients of which betel is compounded is supposed to correct effects which each would produce if used singly; the nut improves the bitterness of the leaf, and the lime prevents any injury to the stomach. The first consequences to the betel chewer are to turn the saliva red, and in progress of time to turn the teeth black. If the lime be omitted, the saliva will not be tinged; and the baneful effects of this caustic earth upon the teeth may be prevented by rubbing them with a preparation, whereby they become permanently coated

with a black substance which preserves them from corrosion. The medicinal effects of betel are to dispel nausea and excite an appetite, and to strengthen the stomach. It also possesses nutritious and enlivening qualities, which render it very acceptable to its consumers. Most travellers have represented betel as being of an intoxicating nature; but Blume rather views the practice as conducive to health in the damp and pestilent regions of India, where the natives live upon a spare and miserable diet. Something of the kind may be needed in consequence of the climate; for it is well known that vegetable stimulants are in most request in tropical countries, and that their inhabitants use commonly as condiments a quantity of pepper, cayenne, etc., which no ordinary European could endure without long habit and training. The betel chewers carry the ingredients for compounding betel about with them, and serve it to their guests on all occasions; to the prince in a gold stand, and to the poor in a brass box or mat bag. The betel stands of the upper ranks are usually of silver, embossed with rude figures. When the first salutation is over, which in Sumatra consists of bending the body, and the inferior putting his joined hands between those of the superior, and then lifting them to his

forehead, the betel is presented as a token of hospitality and an act of politeness. To omit it on the one hand, or to reject it on the other, would be an affront, as it would be also in a person of subordinate rank to address a great man without the precaution of chewing it before he spoke. All the preparation consists in spreading on the betel leaf a small quantity of chunam, and folding it up with a slice of areca nut. The red hue which is communicated to the mouth and lips is esteemed ornamental, and an agreeable flavour is imparted to the breath. The juice is usually, after the first fermentation produced by the lime, though not always, swallowed by the chewers of betel. In some countries, it is not unusual for the guest who receives the betel from his host to pass it between his thumb and forefinger, so as to remove the lime of his host, after which he applies his own. This practice never gives offence, and is supposed to have originated in consequence of the horrible practice, once so common, of mixing up poison in the lime. During the fast of Ramadan, the Mohammedians abstain from the use of betel while the sun continues above the horizon; but excepting at this season it is the constant luxury of both sexes, from an early period of childhood till,

becoming toothless, they are reduced to the necessity of having the ingredients previously reduced to a paste for them, that without further effort the betel may dissolve in the mouth. The areca nuts are also used in some parts of India for dyeing cotton cloth. The leaf stalks, spathes, and timber, are employed for many domestic purposes, as in others of the tribe; and in Malabar an inebriating lozenge is prepared from the sap.

Caryota urens, called *nibung* by the natives, is another of the Asiatic palms, and is widely diffused over the tropical portions of that continent, especially in mountainous situations, where, according to Dr. Roxburgh, it grows to be one of the largest of the tribe. Its trunk is ordinarily sixty feet high, and thick in proportion, and slightly marked with annular scars, produced by the fall of its leaves. The wood is so hard as to be cut with considerable difficulty, and is consequently valuable, provided the soft central portion of the stem is removed. The fruit is about the size of a plum, and has a thin yellow rind, so acrid that it produces a severe sensation of burning if applied to the skin; hence its name, "*urens*." It is generally stated, apparently upon the authority of Rumphius, that this noble tree yields no sap fit for

manufacture into wine, and that the sago obtained from the stem is of such inferior quality as to be of use only in times of famine. Dr. Roxburgh, however, gives a very different statement. He says, "This tree is highly valuable to the natives of the countries where it grows in plenty; it yields them during the hot season an immense quantity of toddy or palm wine. I have been informed that the best trees will yield at the rate of one hundred pints in the twenty-four hours. The pith, or farinaceous part of the trunk of old trees, is said to be equal to the best sago; the natives make it into bread, and boil it into thick gruel. I have reason to believe this substance to be highly nutritious. I have eaten the fruit, and think it fully as palatable as that obtained from the Malay countries." Mr. Bennett, also, in his work on Ceylon, states that the toddy of this palm is so very luscious that it is only drunk when that from the cocoa nut cannot be obtained. Eight gallons of this sap, boiled over a slow fire, will yield four gallons of very thick syrup. To this is added small pieces of the bark of the *halgas*, (*Shorea robusta*), and being again boiled, jagghery is the product, not only superior in quality to that obtained from the cocoa nut, but also double in quantity. The

Candyan jagghery is made entirely from this syrup, and will keep good for several years. Some of fine quality is used as a substitute for Chinese sugar candy, and is made expressly for head men. Each cake of jagghery is separately wrapped in a piece of the dried leaf of the plantain, (*Musa sapientum*,) or banana, (*Musa paradisaica*,) and then suspended where smoke has free access to it, till required for the market, or for other purposes. The shape and size of a cake of common jagghery is that of the bun of English pastrycooks. The stem, which is perfectly straight, is used for posts in building houses, and especially in the construction of palings or fences. The outer portion of the trunk being strong and hard, and the interior very spongy, the tree can easily be excavated, and then forms useful gutters or channels for the transmission of water. The bud or germ of future foliage at the top of the tree is, like that of many other palms, edible, and more delicate than that of most, the flavour of the tenderer parts bearing a great likeness to that of a fresh filbert.

Borassus flabelliformis is another extensively diffused Indian palm, growing all over that part of Asia and the Asiatic islands. It has many names. In the Sanscrit it is called *tala*; in

Borneo, the *sagwire*, or *gomuto*; in Portuguese, *palmeira brava*; and by the English, *palmyra*. The trunk is from twenty-five to forty feet high when full grown, and tapers slightly upwards. The leaves are fan-shaped, about four feet long, and placed upon stalks of about the same length, which are prickly at their edges. The leaf is divided into from seventy to eighty rays, which are ragged at the end, and the largest of which are placed in the centre. It was on these leaves that the Indian islanders principally wrote, before the use of paper became common from commerce with strangers. The leaf was prepared for this purpose much in the same way as the talipat leaf, the mode of treating which we have already described. The middle portion of the leaf is formed into *punkahs*, or fans, in Ceylon, the spines of the leaf stalk being previously cut off. They are sold either plain or lacquered, and a Buddhist priest is never seen without one. They are usually made either of a heart-shaped, or a circular form, and are often mounted on carved ivory handles. The fruit of this palm is about the size of a child's head, three-cornered and three-seeded. When young, the shell is so soft that it may be readily pierced by the finger, and the pulpy matter which it then contains is

cool, sweet, and refreshing, and is used by the Chinese as a sweetmeat; but when ripe, all this changes to a hard bluish kernel, which is insipid and uneatable. The outer wood of the stem, when old, becomes very hard, and although scarcely to be cut transversely, nevertheless readily divides in a longitudinal direction; it is capable of taking a fine polish, and is frequently made use of for bows. It is known in commerce by the name of *palmyra wood*. The sap, which is drawn from the tree in the same manner as from other palms, is described by sir W. Jones as being "as pleasant as Pouchon water fresh from the spring, and almost equal to the best mild Champagne." It is from this tree that toddy is chiefly procured in Borneo, and large quantities of sugar are obtained by the evaporation of the fresh liquor. Happy would it be for those provinces if it were always applied to so innocent a purpose; but arrack, the bane of tropical India, is easily and extensively distilled from it. Dr. Royle* mentions a curious circumstance in relation to this palm, as being a common phenomenon in India, namely, that of a palm growing out of the centre of a Banian tree. It is occasioned thus:—The seed of the Banian tree, dropped

* Illustrations of Himalayan Botany, vol. i. p. 339.

perhaps by birds, germinates on the moist upper parts of trees of this species, and thence sends down its descending shoots, which in time coalesce and entirely inclose the palm, which finally appears with only its crown of leaves projecting beyond the top of the trunk of a lofty Banian, out of which it appears to grow, though actually older, and, like it, having its roots fixed in the ground. Martius mentions a similar phenomenon in his South American travels, during which he saw many such palms, on the thickly-wooded banks of the Rio Guama, entirely cased, except the terminal plume of foliage, with the stems of some of the numerous woody creepers which bind the forests of that region into one huge mass of vegetation.

We now turn from the palms of the Asiatic continent, of which we have noticed those most remarkable, to those of the islands of the Asiatic seas, and of these we must give the first place to the sago palms.

Arenga saccharifera (*Saguerus Rumphii*, Roxburgh) is one of these, and is found in all the islands of the Indian Archipelago, the Moluccas, the Philippines, etc. It is a plant of an ugly appearance, an unusual circumstance in the most elegant of the vegetable

tribes. Its trunk is twenty or thirty feet high, covered almost entirely with coarse black fibres resembling horse-hair. The leaves are from fifteen to twenty feet long, and pinnated. Their leaflets, which are from three to five feet long, widen gradually to the end, where they are ragged and prickly, in consequence of the projection of their hard veins beyond the margin. Above they are of a deep shining green, but on their under surface they are firmly coated with ash-coloured mealy matter. The stalks of these leaves have, intermixed with their coarse hair, stiff bristles as thick as porcupines' quills. Each bunch of flowers is from six to ten feet long, and when covered with fruit, is as much as a man can carry. Each fruit is about the size of a medlar, and, like those of *Caryota urens*, so extremely acrid that it excites severe inflammation in the mouths of those who chew it. It was the basis of the "infernal water" which the Moluccans used in their wars to pour over their enemies. It is remarkable, however, that from the kernel and unripe fruit is prepared a delicious kind of sweetmeat, which the Chinese and Indian nobles take with their tea; it is prepared by soaking the fruit in lime water, and then boiling them in refined sugar.

This palm is highly valued in the islands

where it grows for the wine or sap which it affords, in common with so many species of this order. It flows profusely from the wounded branches of the inflorescence about the time when the fruit is forming. A bamboo bottle is tied to the extremity of an amputated branch, and removed twice a day—morning and evening. When first drawn from the tree it is transparent, with the taste and colour of new wine. After a short time, it becomes turbid and milky, and acquires a slight degree of acidity. When considered fit for drinking, it is of a yellowish colour, with a powerful odour, and a good deal of astringency, and strangers do not for some time become accustomed to it. It is exceedingly intoxicating, but if drunk in moderation, is said to be stomachic and wholesome. Besides yielding wine, the coarse fibres of the stem and leaf-stalks are manufactured into powerful cables. The leaf-stalks alone yield from four to seven pounds of these fibres, which resemble horse-hair, and are called "*gomutie*." They are also employed for stitching together thatch, for making brooms, and other similar purposes. It is thought that the "vegetable bristles," now so largely imported for making brooms, are the same article. The mid-ribs of the leaflets are converted into pens,

(called *pansuri*,) and the fine arrows which the Indians blow from their long tubes. There is also at the base of the leaves a fine woolly material, called *baru*, much employed in caulking ships, as stuffing for cushions, and as tinder. The young terminal bud in the heart of the leaves is an esculent, like the "cabbage" of the *Areca oleracea*, and other species. When the trees are exhausted by the incessant draining of their fluids for arrack, toddy, and sugar, sago of good quality is obtained from the trunk, and as much as 150 to 200 pounds is yielded by a single tree. The wood is extremely hard, and is used for building purposes.

But *the* sago palm, *par excellence*, is the *Sagus lavis*, a tree which inhabits the eastern portion of the Indian Archipelago, and from which the natives of those islands derive the farinaceous nutriment which other nations of the world derive from the Cereals or roots. Except the Nipa, it is in stature one of the humblest of the palm tribe, its extreme height seldom exceeding thirty feet; and except the Gomuti, it is the thickest or largest, a full-grown tree being with difficulty clasped between both arms. In the early period of its growth, and before the stem has formed, this palm has all the appearance of a bush of many shoots. Until the stem

has attained a height of five or six feet, it is covered with sharp spines, which afford it protection against the attack of the wild hog or other depredation. When, from the strength and maturity of the wood, this protection is no longer necessary, the spines drop off. Before the tree has attained its full growth, and previously to the formation of the fruit, the stem consists of a thin hard wall, about two inches thick, and of an enormous volume of spongy medullary matter, like that of alder. It is this medullary matter that affords the edible farina, which is the bread of the islanders. As the fruit forms, the farinaceous medulla disappears; and when the tree attains full maturity, the stem is no more than a hollow shell, affording a striking example of the physiological fact already mentioned.* The utmost age of the tree does not exceed thirty years. The sago palm is an inhabitant of low, marshy situations, and does not grow in dry or mountainous places. A good sago plantation, or forest, is a bog knee-deep. There is but one species of this palm, but four varieties, namely, the cultivated, the wild, one distinguished by the length of the spines on its branches, and one altogether destitute of spines. The first and

* See pp. 19—21.

last afford the best farina, the second a hard medulla, and the third, which has a comparatively slender trunk, an inferior quantity.

The sago, like other palms, is propagated from the seed or fruit, which is of inconstant shape and size, from that of a prune to that of a pigeon's, or even of a pullet's egg. The true native country of the sago palm appears to be that portion of the Archipelago in which the easterly monsoon is boisterous. This geographical range embraces the eastern portion of Celebes and Borneo, to the north the island of Mindanao, to the south Timor, and to the east New Guinea. It is most abundant in the islands chiefly distinguished for the clove and nutmeg, and its geographical distribution seems co-extensive with that of these spices. The great island of Ceram is, of all others, the most distinguished for the production of the sago palm. Here it is found in immense forests in its wild state. If this palm be an indigenous product of the western countries of the Archipelago, as sometimes insisted on, it is a rare one, and the pith is seldom extracted or used as bread.

Of all the plants which supply nutritious farina for human aliment, the sago palm affords at once the most obvious, easy, and

abundant one. The pith of the tree, when ground down in a mortar, deposits the farina immediately, and without difficulty. Unlike, also, to the other large sources of farinaceous food, this tree exists in great abundance, and probably such is the extent of the native forests of it, that centuries must have passed away before the first savage inhabitants were necessitated to have recourse to any mode of culture. The sago palm is not, therefore, as in the case of the *cerealia* and the other useful and nutritive plants, multiplied only by the industry of man, through the medium of one tribe, known everywhere by one common name; but each tribe has its own vernacular term for it and very commonly a distinct name for the farina obtained from it. Thus, in the Ternati language, the tree is called *Huda*; in that of Amboyna, it is termed *Lapia*, and the farina *Sagu-maruka*; in that of Banda, the word for the tree is *Romiho*, and for the farina *Sangyera*.

It remains to give a sketch of the sago harvest, (if such an expression may be used,) and of the modes of preparing the farina for consumption, together with the secondary uses to which this palm is applied. There is no regular fixed season for extracting the pith, which is taken as occasion requires, and as the

individual trees become ripe. The length of time in which this happens depends on the nature of the soil in which the sago grows. Fifteen years may probably be reckoned an average time for the tree to come to maturity. It is not, however, by a calculation of the tree's age, but by its appearance, or by an actual experiment on the pith, that the period of maturity is determined. The inhabitants of the Moluccas note six stages in the progress of the maturity of the medullary matter, the earliest of which is marked by the appearance of an efflorescence on the branches, and the last by the commencement of fructification. The pith may be extracted in any of these stages, and sometimes the natives, trusting to their experience, proceed to the harvest from the mere appearance which the tree presents. More frequently, however, a hole is bored in the trunk, and some of the pith actually extracted, and its maturity examined. When the pith is ascertained to be ripe, the tree is cut down near the root, and the trunk subdivided into portions of six or seven feet long, each of which is split into two parts. From these the medullary matter is taken, which, by means of an instrument of bamboo or other hard wood, is forthwith reduced to a powder like sawdust. The process of sepa-

rating the farina from the accompanying bran and filaments is simple and obvious, and consists merely in mixing the powdered medulla with water, and passing the water charged with the farina through a sieve at one end of the trough in which the mixture is made. The water so charged is made to pass into a second vessel, where the farina falls to the bottom, and after two or more washings is fit for use. This is the raw sago meal, which keeps without more preparation a month. For further use this meal is made into cakes, which keep a long time. These cakes are formed in moulds of earthenware, divided into compartments. The moulds are first heated, and the dry meal being thrown into them, a cake is formed in a few minutes, so that one heating of the mould serves to bake several series of cakes. They are, according to the country in which they are made, of various forms and sizes. Those of Amboyna are half a foot long, and three or four inches broad; those of Ceram are much larger, and excessively hard. These cakes, strung on a filament of cane, are the form in which the sago is chiefly exposed for sale in the markets, and that in which the largest proportion of it is consumed. A considerable quantity of the sago meal is also consumed in

the form of a pap or panado, which is commonly eaten with a fish soup prepared for the purpose. For exportation, this finest sago meal is mixed with water, and the paste is rubbed into small grains of the form and size of coriander seeds. This is the appearance of sago as we see it in England, and is too well known to require further description. In whatever way prepared, the farina of sago is inferior in quality to the *cerealia*; and the superiority of the latter is sufficiently confessed by the preference shown for them even by the natives of the sago countries themselves. Forrest, after a long eulogy on sago bread, says, "I must own my crew would have preferred rice; and when my small stock which I carried from Balambangan was near expended, I heard them grumble and say, 'We must soon eat Papua bread.'"

The different portions of the sago palm are applied to various economical uses. The hard wood of the trunk, called *kururung*, is used in their buildings and in their bridges, as well as in making large troughs and similar vessels. The main leaf-stalk, called *gaba-gaba*, which is deeply channelled on the upper surface, is of still more general application, being used in house-building, in fortification, and in the palings of gardens and other inclosures. The

leaf is in general use as thatch. "The bran, or refuse of the pith, called *ela*, is used in feeding hogs. When thrown into heaps it putrefies, and an edible mushroom, of very delicate quality, grows on the heaps. In the same heaps, as well as in the decayed wood, a worm of a white colour, with a brown head, is generated, resembling a palmer worm. The natives of the Moluccas, like the ancient Romans, who held certain wood-worms dainties, consider them great delicacies; and some Europeans, who have conquered their first aversion, have entered into their tastes."

Of the fecundity of the sago palm we want means to speak with precision. The mass of nutritive matter afforded by this palm is certainly prodigious, and far exceeds that of all other plants. Five hundred, or even six hundred pounds, it appears, is not an unusual produce for one tree. Allowing, however, for the plants that perish, and for the unproductive or barren ones, perhaps we shall not err greatly if we take the average rate of produce at three hundred pounds avoirdupois. Supposing the trees, then, to be ten feet asunder, as is practised with the other larger palms, an English acre will contain 435 trees, and yield 120,500 pounds of raw meal, or above 8,000 pounds a year. The best sago is the produce of Siak, on

the northern coast of Sumatra. This is of a light brown colour, the grains large and not easily broken. The sago of Borneo is the next in value. It is whiter, but more friable. The produce of the Moluccas, though greatest in quantity, is least esteemed. The cost of granulated sago from the hands of the grower or producer, is about a dollar (four shillings and twopence) per *picul* (133½ pounds.) In the market of Malacca, the sago of Siak may be had at two or three dollars (eight shillings and fourpence to twelve and sixpence) per *picul*. The Chinese have invented a process by which they give sago a fine pearly lustre ; but not more than four hundred or five hundred piculs of this are manufactured. In European commerce, two kinds of sago are commonly met with, pearl sago and brown sago. This pearl sago is not the same as the Chinese article just named ; it has no pearly lustre, and occurs in small white grains, often slightly tinged with brown. The brown sago is in much larger grains, and commonly more tinged with brown ; it is, however, the better article of the two. Both kinds are almost entirely soluble in boiling water, forming a thick, starch-like solution, which may be used as a pudding, or prepared in other ways, as a light, digestible, and nutritive article of diet for invalids and children.

Of a very different appearance is the next palm we have to mention ; so different, indeed, that to a careless or slight observer, it would not seem a palm at all, but would either be esteemed a kind of vine or enormous grass. We refer to the genus *Calamus*, which contains a great many species, and which are true palms, though so unlike in aspect to those already described. Their slender stems, which are the canes of commerce, are of enormous length, and climb over the trees and bushes in the close, damp forests of the Asiatic islands, where the sun's rays can scarcely penetrate. In such places they form spiny bushes, which obstruct all passage into those jungles, rising to the tops of the highest trees, and then falling again, so as to resemble a prodigious length of cable, adorned, however, with the most beautiful leaves, pinnated, or terminating in graceful tendrils. The different species of *calamus* are principally confined to the hotter parts of the East Indies and the Indian Archipelago, and some of them are the longest of known plants. The stem of *Calamus verus* is stated to be one hundred feet long ; that of *Calamus oblongus*, three hundred to four hundred ; *Calamus rudentum* is said to be upwards of five hundred feet long ; and *Calamus extensus*, six hundred

feet. Rumphius even states that one kind attains the extraordinary length of twelve hundred feet, nearly a quarter of a mile.

The stems of all the species are closely covered over by the tubular bases of the leaves, through which they are drawn by the cane-gatherers when green, and after being dried in the sun they are ready for the market. The cane-cutter proceeds in the following manner :— He goes into the forest without any instrument but his parang or cleaver, and cuts as much as he is able to carry away. He makes a notch in the tree, from near the root of which the rattan or calamus is growing, and then cutting the latter, strips off a portion of the outer bark, (more correctly, the tubular sheaths of the leaves,) and inserts the peeled part of the stem into the notch. He now, having fixed the cane by one end, proceeds to pull it through the long leaf-sheaths, which is easily accomplished, and when it begins to diminish in size he cuts it off. When the wood-cutter has obtained by this means from three hundred to four hundred rattans, which are as many as an individual can conveniently carry, he ties up his bundle, and after drying they are fit for the market. They are sold very cheap. The Chinese junks obtain them in Borneo at the rate of about

thirty-seven for a penny. The resident European merchants always dispose of them by weight, the price being from $1\frac{1}{2}$ to $2\frac{1}{2}$ dollars per picul. Nearly four millions of these canes were imported into this country in 1832. They are extensively used for the sake of the hard flinty coating of their stems, which are readily split into strips, from which the bottoms of chairs and similar articles are manufactured. It is impossible to say from what particular species the canes of the shops are obtained, it being probable that many are gathered indiscriminately. *Calamus rotang* has, however, been said to furnish the stoutest, and *Calamus scipionum* the slenderer sorts. The forests of Borneo and Sumatra, and of some parts of Celebes, furnish the most abundant supply. Limpid water flows from the stems when cut through; and the young shoots of some species, while still tender, are roasted or boiled, chopped small, and being fried with pepper and gravy, are said to furnish a very delicate dish.

It is not a little remarkable that, notwithstanding the polished surface of the stem, almost all the other parts, except the fruit, should be furnished with stiff hairs, and even prickles. The prickles are hooked backwards, to enable the plants to raise themselves upon

the trees among which they grow in their native forests, and to assist in the same object the leaflets nearest the end of the leaf are short, hardened, and hooked backwards, so as to afford a number of additional points of support.

The gum resin, called *Dragon's blood*, is another important product of the *Calami*, and is obtained from the fruits of several species, chiefly from *C. petraeus*, *C. rudentum*, *C. verus*, and *C. draco*. Their ripe fruits are covered with a reddish brown, dry, resinous substance. In this state they are collected, and allowed to remain in rice mills till the resin drops off. It is afterwards melted, either by the natural warmth of the air or by artificial heat, and then moulded into the different forms in which it occurs in commerce. Another mode of obtaining it is as follows:—The ripe fruits are shaken in bags, and the resin so obtained is formed into pieces about the size of a bean, which are then wrapped up in leaves; this kind is much prized in the East Indies. A second sort is procured by throwing together the fruits after they have been treated in the foregoing manner, melting them in the sun, or with a slow fire, and collecting what exudes, which is then formed into four-cornered cakes. One species of this palm, called by the natives the *salak*, affords

a fruit about the size of a pullet's egg, which consists of a hard stone or kernel, enveloped by a firm white pulp, which is covered by thick husks, in colour not unlike the back of an adder. This fruit has a strong odour, a mealy and acid flavour, which is much esteemed by the natives, who cultivate it extensively in their gardens.

The last of the Asiatic palms which we have specially to mention is the *Lodoicea Sechellarum*, a palm of singular character, and confined to two or three of that group of islands lying to the north of Madagascar, known by the name of the Seychelles. Many centuries before the islands were discovered its existence was known, in consequence of its remarkable nuts being often thrown on the shores of the Maldivé islands, whither they were carried by the oceanic currents. No tree being known to produce such nuts, it was supposed, and currently affirmed, that the tree which bore them grew at the bottom of the sea; and the votaries of Vishnoo devoutly believed that when that deity was churning the ocean, he broke off several of the branches from the tree that they might float on the surface, and be a specific for all the ills that afflict mankind. From this fable it acquired the name of *coco do mar*, by which name it is known still. From the

passion which existed among the old botanists and physicians for discovering medicinal virtues in every plant and tree, it was not to be expected that they would allow so singular, rare, and mysterious a production as the *coco do mar* to pass without attributing to it special virtues; and accordingly we find it magnified as a sovereign antidote against poisons of all kinds, a cure for all pestilential diseases, and a remedy for epilepsy, palsy, and fevers; while, as may be readily imagined in the case of so scarce and so sovereign a remedy, it bore a very high price. The inquisitive spirit of later days has, however, failed to endorse these supposed virtues, and we find them now considered entirely apocryphal, and the nut is only esteemed as a rarity and curiosity. Specimens were in the Great Exhibition among the articles from the Mauritius. It is commonly known by the name of the "double cocoa nut."

The tree yielding these fruits was first discovered by Barré, a French officer of engineers, in 1769. It attains a height of eighty or ninety feet, and is surrounded by a crown of singular leaves, partly winged, partly palmated, which open like a fan. The diameter of the stem is only from twelve to fifteen inches, and it is so flexible that it waves to the slightest breeze.

When the wind is moderately strong, the huge leaves of this giant palm are clashed together with an astonishing noise. The leaves are of large size: when young they are more than fifteen feet long, and with a leaf stalk at least as much more; but when full grown, the leaf stalk is not more than eight or ten feet long, and the leaf is about twenty feet in length by ten or twelve in breadth; it is entirely destitute of thorns. The nascent leaves are enveloped till the period of their expansion by a thick covering of cottony down, of a nankeen colour; but this is occasionally wanting. This down is used for stuffing pillows and mattresses. The tree produces but one leaf in a year, according to the unanimous testimony of the inhabitants; and as the trunk only increases in height eight inches for every three leaves that it puts forth, and as twenty years expire before the stem appears above the surface of the ground, a tree of eighty feet in height must be about four hundred years old. The flowers, which are about twenty in number, succeed each other one at a time; occasionally there are two together. The nuts are two-lobed, and sometimes two nuts are inclosed in one husk; three-lobed nuts are very rare, but some are met with, and it is said that specimens with five

lobes have been found. The form of the nuts is singular, and cannot be compared with that of any other production of the vegetable kingdom. Two highly remarkable circumstances in the history of the *Iodoicea* are the duration of its blossoms, and the period necessary for maturing its fruit; for the latter purpose seven or eight years are required.

The *Iodoicea* grows in every variety of soil, but delights most in the vegetable mould of the deep gorges of the mountains. It is nevertheless found on the bare mountain tops, and forms a very conspicuous and remarkable object in such situations. It is curious that the vegetation of the nut should be prevented by its being buried; but if suffered simply to rest on the ground, in a situation not too much exposed to the sun, germination readily takes place. The purposes to which the produce of the *Iodoicea* is applied are numerous. The fruit in its simple, fresh state, is an agreeable and refreshing aliment; when ripe it yields oil; its germ furnishes a very sweet food. Of the shell are made vessels of various shapes and sizes, that serve the Seychellois for nearly all domestic purposes. The entire nut is an article of commerce with India, where one of its uses is as an astringent medicine. The trunk is employed in building;

split and hollowed, it forms excellent gutters and palings; the leaf stalks are also used for the latter purpose. The leaf forms a covering for roofs, nearly as good as shingles; besides furnishing materials of a very superior description for hats, bonnets, baskets, and artificial flowers, in the manufacture of which the Seychellois display great taste and skill. The leaves are so firmly attached to the trunk that a man may seat himself at the end of one with perfect safety. The fruit is fifteen inches in length, about three feet in circumference, and weighs from thirty to forty pounds. As many as seven well-formed fruits are sometimes seen on a single spadix. The fecundation is occasionally imperfect, and then the ovary expands and lengthens, but does not assume its usual form, and at the end of two or three years it falls off. A female plant at Mahè flowered for several years without producing any fruit, owing to the absence of a male plant. In 1833, a male flower was procured from an estate a few miles distant, and suspended in the tree. About two months afterwards, one of the buds expanded, and the mature fruit dropped from the tree at the end of 1841. All attempts to transplant this tree to the other islands have hitherto proved fruitless.

CHAPTER V.

THE PALMS OF AMERICA.

ALTHOUGH by far the largest portion of the palm tribe belongs to America, though the number of species indigenous to that part of the earth's surface is far greater than even Asia can boast, yet in point of social, economical, and commercial importance, it must be confessed that the American palms seem to hold a lower rank. This inferiority, however, *may* be only apparent and temporary ; it may arise from the very partial acquaintance we have with them ; and it may eventually prove that not only are the American palms more numerous, but of more social importance than even those of the old world. We shall see that not only are many species already turned to useful account, but that facts are known of others, which will probably lead to their economical application.

The first we shall mention is *Areca oleracea*,

(*Oreodoxa oleracea*,) a palm which abounds in Jamaica, and others of the West Indian islands, where it is commonly known as the "cabbage palm." It is familiar to most persons from the allusions to it in the favourite tale of Paul and Virginia, and from the oft-repeated fact that a tree of the growth of half-a-century is sometimes cut down for the sake of the single bud which terminates it, and which is called the "cabbage." It is found in great abundance in the mountainous parts of the West Indian Islands, and grows to the height of one hundred to two hundred feet, with a trunk not more than six or seven inches in diameter. The great height of this delicately slender stem, together with its terminal plume of feathery leaves, each fifteen feet long, give it a most graceful appearance. The leaves are divided in a pinnated manner, and the leaflets are deep green, and several feet long. The unexpanded leaves are arranged so closely one over the other as to obstruct all access of light, which causes them to be of a very tender and delicate nature. It is this which forms the cabbage, which is considered a great delicacy either raw or boiled. Independently of the use of this palm as an article of food, its trunk when felled and exposed to the air quickly rots in the

centre, and becomes a natural hollow cylinder, which, on account of the hardness of the outside wood, forms a very durable water-pipe, often as much as one hundred feet long, and is said to become when buried almost as hard as iron. The wood is sometimes imported under the name of "cabbage wood," and has a beautifully mottled appearance; but it does not answer trade purposes very well, as the ends of the fibres are too hard, and the medullary portion too soft for holding glue.

We have already mentioned *Ceroxylon Andicola*, the wax palm of the Andes, as having been discovered by Humboldt and Bonpland on some of the mountains of that magnificent chain, at an elevation approaching in its mean temperature to the climate of middle Europe. Growing in a region generally considered as beyond the limits of the true palm world, attaining a lofty height, which renders it one of the most imposing of its noble tribe, and covered with a singular secretion, it claims our notice as one of the most remarkable of the family to which it is allied. It has received from the American Spaniards the name of *Palma di cera*, or wax palm, on account of the abundance of that substance which is yielded by the stem. It grows, according to Bonpland, on the Andes, in $4^{\circ} 35'$

north latitude. Below the snow-capped mountains called Tolima, San Juan, and Quindiu, especially the last, the *Ceroxylon* grows in all its grandeur, elevating its majestic trunk, coated with a thick incrustation of wax, to a height of one hundred and eighty feet, among the most rugged precipices of the wild region which it inhabits. Unlike the greater part of the palm tribe, this species avoids the heat of tropical climes, and seems incapable of existing except in regions where the temperature is lowered by elevation in the air, and the contiguity of perpetual snow. It is said to make its first appearance on the sides of the Quindiu at a height equal to that of the Puy de Dôme, or the passage of Mont Cenis; this is higher than the region of Cinchonas, and so cool that Humboldt does not estimate the mean temperature of the year higher at the utmost than 65° to 68° Fahrenheit, which is at least 170° lower than the mean temperature of palm countries. It does not extend over more than fifteen or twenty leagues of country altogether. Its roots are fibrous and very numerous, the main root being thicker than the stem itself. The trunk is distinctly marked with rings, caused by the fall of the leaves, which are from eighteen to twenty feet long. The spaces between these

rings are pale yellow, and smooth like the stems of a reed, and are covered with a coating of wax, (whence the palm takes its name,) two inches thick. According to the analysis of Vauquelin, it is not pure wax, but is composed of one-third wax and two-thirds resin. Melted with one-third of fat, it makes excellent candles.

But this remarkable exudation is not peculiar to the ceroxylon, but possessed in common with it by a Brazilian palm, belonging to the same genus as the talipat, and talliera palms of Asia. It is the *Corypha cerifera* of botanists, and is found in wooded plains on the banks of the Rio San Francisco, and in the interior of Bahia and Pernambuco. It is called by the natives *Carnauba*, and the wax which it yields is occasionally met with in commerce under the name of Carnauba, or Brazilian wax. It is a very singular, and at the same time a very beautiful species. It is most remarkable in how diversified a manner the same general form is presented to us in the different species of plants which form a natural family, nor is this least striking in the palms. The species before us is instantly recognised as a palm—every feature declares its family—and yet it is most distinct in its habits and appearance from

any other. The stem is entirely covered with huge scales, the ends of which turn outwards, very much like the scales of an old fallen fir-cone. These scales are nothing else than the bases of the leaf stalks which remain after the leaves are fallen away and have perished ; it will be remembered that the stem of *Elais guineensis* was described as being similarly clothed. But the leaves form the distinguishing character of this beautiful tree. They are palmate, as in the other species of corypha, and exceedingly numerous, and, including their petioles about six feet long. They are collected together into an enormous, globular head of leaves, which surmounts the summit of the trunk of the palm, giving it a most extraordinary appearance. The leaf stalks are armed with strong thick spines ; and from the surface of the leaf the wax exudes in flakes, which are collected by the inhabitants, and being mixed with bees' wax are employed as an article of commerce, and also for various domestic uses. The fruit is bitter, and generally rejected as an esculent ; the Indians, however, are said to rank them with their delicacies, and to eat them either raw or cooked ; parrots and monkeys greedily devour them. These palms sometimes grow solitarily, and sometimes are so numerous as to form dense woods.

Mauritia flexuosa, the Moriche, Quieteva, or Ita palm, is another of the South American palms, belonging to that section of the palm tribe which includes the genera *Sagus* and *Calamus*, already described. It is an elegant species, with a trunk twenty-six feet high, which size it probably does not attain to in less than a hundred and twenty or a hundred and fifty years. Linnæus has erroneously described it as being destitute of leaves. It frequents the mountains of Ronaima, near the source of the Orinoco, up the slope of which it is found as high as 4,263 feet. It is also found at the mouth of the Orinoco, on the delta of that river. It delights in moist ground, forming fine groups of a fresh and shining verdure, reminding us of that of our alders. These trees preserve the moisture of the ground by their shade, and hence the Indians believe that the *Mauritia* draws water around its roots by some mysterious attraction. By one writer it has been called "the tree of life," and it may perhaps not inaptly be so termed with respect to one tribe, the *Guaranés*, an unsubdued race who live near the mouth of the Orinoco, and subsist on this tree. We are told that when, in consequence of their increasing numbers, they became overcrowded, they not only built

huts on horizontal platforms, supported by the stumps of these palms, but ingeniously suspended from stem to stem of the growing trees, spreading mats or hammocks woven from the leaf stalk of the *Mauritia*, which enabled them during the rainy season, when the Delta was overflowed, to live in the trees in the manner of apes. These pendant huts were partly covered with clay, and the women kindled the fire necessary for their culinary operations on the humid flooring. As the traveller passed by night along the river, his attention was attracted by a long line of flames, suspended high in the air, and apparently unconnected with the earth, forming a sight both extraordinary and startling to those who were previously unacquainted with the habits of this singular race. To the *Mauritia* palm we may say that the Guaranés owe their independence, for the loose marshy soil of their country renders it of very difficult access to any but such as are able to move over it with an equally fleet and buoyant step to that of these Indians, while their lofty sylvan domiciles render them still more secure.

The *Mauritia* not only affords a secure habitation, but likewise yields numerous articles of food. It is the sago tree of America, furnishing food and clothing, flour and wine, and

thread to weave hammocks, baskets, nets, and cloth. Before the tender spathe unfolds its blossoms on the male palm, the soft portion of the trunk is found to contain a sago-like meal, which, like that of the jatropha root, is dried in thin bread-like slices. The sap of the tree, when fermented, constitutes the sweet inebriating palm wine of the Guaranés. The fruit is narrow, and covered with reddish scales, so as to resemble perfectly the fruit of the *Calamus rotang*, or (to employ a comparison more familiar to English eyes) nearly like fir cones. It has somewhat the taste of the apple. Like the banana, and almost all tropical fruits, it yields different articles of food, according to the period at which it is gathered, whether its saccharine properties are fully developed, or whether it is still in a farinaceous condition. When arrived at maturity, it is red without and yellow within. The Araguato monkeys eat it with avidity. This palm, with its large, shining, fan-like leaves, preserves a beautiful verdure at the period of the greatest drought. The sight of it alone produces an agreeable sensation of coolness, and the rich aspect of the Moriche, loaded with fruit, contrasts most singularly and pleasantly with the mournful appearance of the palm of the Llanos, (*Palma de cobija*), *Corypha*

tectorum, the foliage of which is always grey, and covered with dust.

Mauritia vinifera is a gorgeous palm, sometimes a hundred and thirty feet high, and is called Buriti by the natives. It is a tree of very slow growth, though the light spongy texture of the wood might have led us to infer the contrary. It has many uses. The sap, drawn from the tree after the manner of toddy in the east, is acidulous, yet sweet, and so nearly resembling wine in its flavour as to have obtained its name (*vinifera*) for the palm. It is yielded in great abundance. The epidermis (or skin) of the younger leaves, is stripped off, and is of such great tenacity that it makes superior nets and ropes, and is commonly employed in the manufacture of those articles. The leaves are employed to cover roofs, and the leaf stalk is used as an oar. The fruit contains a pulpy mass, which, when prepared with sugar, forms a kind of preserve, named "*sajetta*," which is so highly esteemed as to sell for a hundred and sixty reals (about eighty shillings) per pound. Martius mentions the curious circumstance that a certain number of these noble palms forms the marriage-portion of a bride among the nations where the tree grows, and is by no means a despicable dowry.

Mauritia aculeata is another species of the same genus, discovered by Humboldt in the underwood and thickets of Guiana, where the vegetation appears to be retarded by the continuance of the inundations. It is frequently found in company with the palm next to be mentioned. It is called by the Indians *juria*, or *cauvaja*, and on the banks of the Atabapo and the Terni is found growing in clumps of twelve or fifteen, so close together that they appear to be growing from the same root. We are not aware that any part of this palm is applied to a useful purpose, but it is mentioned on account of a very remarkable circumstance in its appearance, namely, that the leaves are coloured like a peacock's tail. The leaves are fan-shaped, supported on short and very thick trunks, and are bent towards the ground; and at the centre of every leaf, concentric circles of alternate blue and yellow appear, the yellow prevailing towards the middle. It is also formidably armed with strong short thorns, which are very hard and woody, and broad at the base.

Guilielma speciosa is the *Pihijao*, or *Pihiguao*, which was also discovered by Humboldt growing in abundance at San Fernando, San Balthasar, Santa Barbara, and various other places toward

the south and east, along the banks of the Atabapo and the Upper Orinoco, where it gives a peculiar feature to the landscape. "In those wild regions," says this eloquent traveller, "we are involuntarily reminded of the assertion of Linnæus, that the country of palm trees was the first abode of our species, and that man is essentially palmivorous."* The thorn-armed trunk of this palm is more than sixty feet high, the leaves are winged, and the leaflets very thin and frizzled towards the point. The fruit, however, is the remarkable and valuable portion of the palm. Every cluster contains fifty to eighty fruits, three of which grow on each tree; consequently, each palm yields from one hundred and fifty to two hundred and forty fruits, which are nearly globular in shape, and at first of a rich yellow colour, growing purple in proportion as they ripen; they are two or three inches thick, and generally without a kernel. These fruits furnish a farinaceous substance as yellow as the yolk of an egg, slightly saccharine, and extremely nutritious. It is eaten like plantains or potatoes, boiled or roasted in the ashes, and affords an aliment as wholesome as it is agreeable. The subsistence of the Indians of this part of the American continent during several

* *Systema Naturæ*, vol. i. p. 24.

months in the year depends as much on the farinaceous fruit of the pihjao as on the cassava and plantain. The Indians of the missions are unwearied in their praises of this noble palm, which might be called the peach palm. It is cultivated by them with *Jatropha manihot* and Indian corn, and is regarded by them with such veneration that they will not cut it down, though, from the hardness of the wood, it is evidently admirably adapted for the manufacture of a variety of utensils.

Attalea funifera, called by the natives "*Piacaba*," is found in the richest soil in the native forests in the hotter parts of the maritime provinces of Brazil, where it is one of the most valuable gifts which the bountiful hand of Providence has conferred on the inhabitants. The best cordage in America for naval purposes is manufactured from the fibres of the leaf stalks and other parts; such ropes are of great strength, and are extremely durable in salt water, no other cables being employed in a great part of the Brazilian navy. This species does not grow more than from twenty to thirty feet high; and its nuts, which are about as large as an ostrich's egg, have a hard shell like that of the cocoa nut, which is very thick, and is much used for turning into ornaments; they

are known in this country by the name of cocos nuts and coquilla nuts. Such articles are brown, prettily marked, and capable of taking a fine polish.

Iriartea ventricosa is a very remarkable palm. It flourishes on the banks of the Japura, in the primeval woods bordering the course of the Solimoes, and between the Rio Negro and Iça. The stem is eighty feet high, and rises from a dome or pyramid of arched roots, which is five or six feet in height above the surface of the ground. It is marked with rings, and is of equal thickness throughout, except a little above the middle, where it gradually swells, until it reaches double its former thickness, after which it diminishes again, till it is reduced to an equal size with the lower portion, when it retains the same diameter to the summit. Here it is terminated by a splendid canopy of from eight to fifteen large winged leaves, the separate leaflets of which are broad and curiously jagged at the end. The Indians make a variety of domestic utensils from the various parts of this tree. From the external portion of the trunk, which is excessively hard, and black as ebony, they make the clubs which they carry in war, the arrows which they tip with the *urari* poison, and their spindles for weaving.

Joists for the roofs of cottages are made from the split stem; while from the ventricose or bulging portion of it, entire boats are constructed. For this purpose that part of the stem is split longitudinally into two equal portions; the medullary parts are then excavated, and the sides still further thinned by the aid of fire, thus forming a rude boat or canoe. The fronds are employed as thatch to cover the roofs of houses, and to form canopies for the sterns of boats; and the natives are accustomed, when passing the night on the sandy islands with which those tropical rivers abound, on the banks of which this palm grows, to place three or four leaves, with their mid-ribs stuck in the sand, over the head of each sleeper, to defend him from the pestiferous dew of the night.

Of a very different appearance is *Chæmædorea fragrans*, a Peruvian palm, but (compared with the generality of its congeners) of most diminutive stature. It is a reed-like plant, about five or six feet high, and indeed, in appearance, seems to recede from the character of its order, and to approach that of the grasses. It is called *Chutasslium* by the Peruvians, and is especially remarkable for exhaling a most delicious fragrance, which is so powerful as to

fill the groves with its perfume in the months of August, September, and October.

The last of the South American palms which it will be needful to particularize, is that known to botanists as *Phytelephas macrocarpa*, and to the natives of Peru as the Tagua plant, or Cabeza de Negro (Negro's head.)

It grows on the banks of the river Magdalena, in New Granada, and in the groves of Peru, in the hotter part of the Andes. The leaves are used by the natives to cover the roofs of their huts. The fruit, however, is the especially valuable part of the tree. It consists of a number of roundish or egg-shaped, somewhat three or four-sided nuts, which are collected together into a large prickly head, from which the palm derives its name of Negro head. The nuts are the *vegetable ivory* of commerce. When young, they contain a clear tasteless liquid, which is regarded as a refreshing beverage by travellers. In the process of growth, however, this clear liquid becomes milky and sweet, and it changes its taste and consistency by degrees, till at last it is converted into a substance whiter than ivory, and as hard—sometimes harder. The liquid contained in the young fruit becomes acid if this is cut from the tree and kept some time. The

nuts, as they are imported into this country, are contained in a soft external shell of a dirty colour, and about one-eighth of an inch in thickness; the seed or nut is covered with a dark brown membrane, but is of a pure white within, and with, generally, an irregular cavity in the centre. The natives of the districts where this palm grows have used the nuts from time immemorial for the purposes of making buttons, heads to walking-sticks, and various trinkets; but the introduction of the material to Europe as an article of commerce is of very recent date. They are already, extensively employed for the manufacture of almost all the articles for which ivory had been in use before, as far as their size will permit; and as they can be made at a cheaper rate, they will probably continue to be so employed. They are, however, considerably more fragile than real ivory, nor do they retain their colour so well. There is a very considerable difference in the quality of the nuts, some working up with ease, while others are so brittle as to be unmanageable and useless. It is remarkable that the vegetable ivory, if soaked in water, becomes soft, but readily returns to its original hardness when dried. The microscopical structure of the nut is very curious.

By submitting a very thin slice of it to a high magnifying power, it is seen to be traversed by a vast number of tubes, all lying in one direction, and fringed at their outer ends, while from the sides numerous short branches are given off. The tubes are believed to contain oil.

Here we close our illustrations of the living palms. We have endeavoured to collect into a small compass all the more interesting of the facts known respecting them ; but with regard to a race which is so little understood as the palm tribe yet is, and almost every species of which is an exotic to the present race of botanists, a vastly greater amount of valuable facts yet remains, doubtless, to be discovered, both as regards the physiology, and the useful application of these noble trees. The study of modern botany has been so confined to that more civilized portion of our globe, the temperate zone, that the only scientific students of the tribe have been passing travellers, or temporary residents in those countries where its specimens abound. The difficulties which (as already explained) have surrounded their investigations have been such as to render it astonishing that so much is known respecting the palms ; and that obstacles, apparently

insurmountable, have been overcome by the ardour and perseverance of those who have made the subject their special pursuit. The cultivation of many species in our own land will also add to our knowledge respecting them. The astonishing improvements of late years in horticulture have rendered multitudes personally acquainted with the rich botanical treasures of far distant regions, which, but for the advance of this science, could only have been presented to the eye of the mind as they were described by the traveller. Now, the "tarry-at-home traveller" may feast his eyes with the glowing colours and strange forms of the parasitic orchids of the Brazilian or Javancse forest, growing luxuriously in the "orchidaceous house" of our large nurserymen, or in the conservatory of the man of wealth. Bananas, tree-ferns, bamboos, and the giant creepers of equinoctial forests, have astonished the eyes of thousands of our countrymen, as they have surveyed them in the conservatories at Chatsworth and elsewhere; while the graceful and noble forms of the palm tribe are, perhaps, now even more familiar from the beautiful specimens exhibited in the palm house of the Messrs. Loddiges at Hackney, the palm house of the Kew Gardens, and especially in that centre of

attraction to all the land, the transept of the Crystal Palace in Hyde Park, where hundreds of thousands, doubtless, for the first time beheld them in their living majesty. While to the dwellers in our land they have spoken of foreign countries, and strange scenes, and a burning sun, to how many of the visitors to that wonderful scene of the world's industry have they seemed as well-known and familiar faces, speaking of home in a land of strangers! With a similar reference, Mrs. Hemans has most beautifully described a palm tree growing in an English garden :—

“ It waved not in an eastern sky,
Beside a fount of Araby :
It was not fanned by southern breeze,
In some green isle of Indian seas :
Nor did its graceful shadow sleep,
O'er stream of Afric, lone and deep.

“ But far the exiled palm tree grew,
'Midst foliage of no kindred hue :
Through the laburnum's dropping gold
Rose the light shaft of orient mould ;
And Europe's violets, faintly sweet,
Purpled the moss-beds at its feet.

“ Strange looked it there! the willow stream'd
Where silvery waters near it gleam'd.
The lime bough lured the honey bee
To murmur by the desert's tree :
And showers of snowy roses made
A lustre in its fan-like shade.

“ There came an eve of festal hours,
Rich music filled that garden's bowers ;
Lamps that from glittering branches hung,
On sparks of dew soft colours flung,

And bright forms glanced, a fairy show,
Under the blossoms to and fro.

“ But one, a lone one, 'midst the throng,
Seem'd reckless all of dance or song ;
He was a youth of dusky mien,
Whereon the Indian sun had been,
Of crested brow and long black hair,
A stranger, like the palm tree, there.

“ And slowly, sadly, moved his plumes
Glittering athwart the leafy glooms :
He pass'd the pale-green olives by,
Nor won the chesnut flowers his eye ;
But when to that sole palm he came,
Then shot a rapture through his frame.

“ To him, to him, its rustling spoke,
The silence of his soul it broke.
It whispered of his own bright isle,
That lit the ocean with a smile ;
Ay ! to his ear that native tone
Had something of the sea-wave's moan.

“ His mother's cabin home, that lay
Where feathery cocoas fring'd the bay,
The dashing of his brethren's oar,—
The conch-note heard along the shore,
All through his wakening bosom swept :
He clasp'd his country's tree—and wept.

“ Oh ! scorn him not ; the strength whereby
The patriot girds himself to die,
Th' unconquerable power, which fills
The freeman, battling on his hills,
These have one fountain, deep and clear
The same whence gushed that child-like tear.”

CHAPTER VI.

THE PALMS OF THE ANCIENT WORLD.

OUR sketch of the palm tribe would be very incomplete without some notice of those which inhabited the earth in very ancient periods, the records of which are preserved in nature's own herbarium, the fossiliferous rocks—those cabinets full of “medals of creation.” In these we find the remains of great numbers of plants which no longer tenant our earth, among which species of the elegant tribe of ferns are very numerous. The palms seem to have formed a portion of the flora of our globe at a very early period of vegetable life, and to have lifted their plumed heads above the denizens of the forest when *Calamites*, *Lepidodendra*, *Sigillarias*, and other strange plants, swarmed around them, and, by their constant accumulation, were preparing materials for those vast deposits of coal which are now of such inestimable importance. Many and strange are the revelations which geology has made concerning the early inha-

bitants of our planet, both in the animal and the vegetable world. Only a few years ago, many of the wonderful facts which this most interesting study has unfolded were looked upon as the visionary fancies of men whose aim it was to array science in opposition to revelation. But the additional light which more advanced investigation of the subject produced, proved the immutable truth, that the works, the ways, and the word of God, are all in strict harmony the one with the other; and that, if rightly interpreted, they always confirm one another. The infidel has been most signally defeated in every attempt to set the revelations of geology in antagonism with the Scriptures. True science, rightly interpreted, will never, we may without hesitation venture to affirm, be found at variance with the word of God.

In order that the ancient history of the palm tribe may be distinctly understood, it may be needful to explain, as briefly as possible, those leading facts of geological science which bear upon the subject before us. Geologists have discovered that the various rocks of which the surface of the earth is composed have undergone a variety of changes, which have caused them to assume different forms and modifica-

tions. Most rocks may be traced to one of two origins — either they have been consolidated from a liquid state, in which they had been maintained by intense heat, or they have been gradually accumulated by the action of water, wearing down more ancient rocks and lands, and depositing the sediment in the deeper portions of those primitive seas, or at the bottom of the rivers and lakes. The larger portion of the dry land on the surface of our earth is covered with rocks and strata of this character, and in this way sand, mud, and other materials, are at this day accumulating at the bottom of every sea and lake, and at the outlet of every river.

The land and sea have likewise undergone very repeated and extensive changes of relative level, land having sunk beneath the level of the sea, and the bed of the sea having been elevated and become dry land. It is easy to understand how, in the lapse of time, where a portion of the earth's surface has been thus repeatedly submerged and laid dry again, it should have become covered with several series of deposits or distinct strata. As a single example, we may cite the cliff at Lulworth Cove, in Dorsetshire, which exposes on its face a section of several strata, exhibiting to the eye the most

indubitable proof of the following changes:— First and lowermost is the Portland stone, which was evidently formed by the accumulation of calcareous sediment at the bottom of the sea. This at length rose out of the sea and became dry land, was covered with soil, and in due time gave support to a forest of trees. Of this second stage we have the evidence in the vegetable soil still remaining, and in the very numerous remains of trees, many standing upright as when growing. Third: This level of the land on which this forest grew became depressed, and formed a hollow, wherein existed a fresh water lake, indicated by the limestone and the peculiar shells embedded in it, which surmount the “dirt bed.” Fourth: The whole became again covered by the ocean, and was again elevated above the waters, and by some subterranean convulsion the originally horizontal beds have been tilted till they lie at an angle of nearly 45° . Such examples might be multiplied to a large amount.

It is evident that beds or strata formed in the manner above described would, in all probability, contain the remains of fishes, shells, corals, etc. The bones of fishes and cetaceans, and the shells of the mollusca, would, from their firm and calcareous structure, resist decay for

a considerable length of time, and on the death of the animals, and the decomposition of their softer parts, would most likely sink to the bottom, and be there interred as the sediment accumulated; as also would the shells after the death of their inhabitants. It will also be readily perceived that land plants, or at least portions of them, especially wood, might frequently become similarly entombed in the shallower portions at no great distance from the shore.

Processes such as these now sketched have been perpetually going on ever since this earth was habitable, either for the animal or vegetable creation. Guided by the relative position of the strata, the lowermost being of course oldest and first-formed, and also by the animal and vegetable remains which they inclose, the geologist has already been able to trace the general outlines of a physical history of our globe, and to record many of the changes which have taken place upon it.

The various eras or periods of organic life upon the earth, as indicated by the strata and their remains, may be stated at nine. These are,—beginning with the most ancient,—

1. The Silurian.
2. The Devonian, (or old red sandstone.)

3. The Carboniferous strata, (mountain limestone and coal.)

4. The Permian group, (lower new red sandstone, etc.)

5. The Triassic strata, (upper new red sandstone, etc.)

6. Oolite and Lias.

7. Wealden beds.

8. Chalk. And finally,

9. The Tertiary strata.

The earlier strata (the silurian and old red sandstone) contain but few traces of vegetable life, at least as far as researches have at present shown, and these are principally *Algæ*, or seaweeds. But in the carboniferous group of strata the remains of land plants are extremely abundant. Not only is coal itself a mass of vegetable matter—altered, it is true, by burial under high pressure, and perhaps much heat—but it still retains, in many cases, the very form and structure of the original vessels, as can readily be seen when very thin slices are placed under the microscope. The beds of shale (hardened mud) which generally accompany and alternate with the strata of coal, are full of the leaves of plants and fronds of ferns, which are displayed in beautiful preservation on the slabs which are raised in working the

coal. Among these relics of the primeval forests which formed our coal, the remains of palms occur; and although of species no longer existing, yet the character of the tribe is so strongly marked in these remains, as to leave no doubt of the place in the vegetable kingdom to which they are to be assigned. The trunks, the leaves, and the fruits of palms, have all been found in the coal strata. A group of fossil palm trees has been discovered in the state of Indiana, (North America,) in one of the upper members of the Illinois coal field, and has been described by Dr. Owen, of New Harmony. From twenty to thirty erect trees were found with their main roots attached, and ramifying in the clay beneath, and their stems passing through the coal and sandstone above, as if (which doubtless was the case) they had been submerged on the spot where they originally grew, and the sand and coal had been deposited around them. A carbonaceous crust envelops the trunks, which are covered with lozenge-shaped scars, having a transverse direction, and presenting a diversity of figure in the petiole, (leaf stalk,) that indicates at least three species of palms. The leaves of three species of pinnate-leaved palms, and one of a fan-leaved species, have been found

in the English coal beds. The leaflets of one (*Næggerathia flabellata*) are wedge-shaped, like the leaflets of *Caryota*.* The fruits, which may be referred to the palm tribe, are generally oblong, three or six-sided bodies, not more than an inch long, and, according to Dr. Lindley, possess the true structure of palm fruits, and have undoubtedly belonged to a tree of that tribe. They are known to geologists under the name of *Trigonocarpum næggerathi*. They are always seen in clusters, but separate from each other. It would seem as if the bunches of fruit had lain in water till the pulpy parts and stalks rotted away, and the hard kernels settled down into the mud, where they were finally imbedded. They are not uncommon in the coal shales.

Although the remains of palms thus unquestionably occur in the coal strata, they are rare, and bear no proportion to the ferns, sigillarias, lepidodendra, and other characteristic plants of this period. It must not be inferred, however, that they were so rare as the paucity of their remains would seem to indicate. It must be remembered that the coal strata appear to have been formed beneath the water. An interesting experiment by professor Lindley throws

* See Lindley and Hutton's Fossil Flora.

much light on this subject. He took healthy plants of about one hundred and seventy different species, among which were representatives of most of the principal natural families, and immersed them completely in a large tank of water, where he kept them many months. In that time many had perished and become completely disorganized, so that they could not in any way be recognised; others, though much injured, and decomposed, were just recognisable; whilst some few had suffered little, if any injury, from their long immersion. Of those which best resisted the action of the water, the pines and firs, and the ferns, were especially remarkable for their perfect preservation, except that the ferns all seemed to have lost their sori (or clusters of capsules.) This result remarkably corresponds with the phenomena of the coal strata, where the ferns are some of the best preserved species; and it is also very singular that in very rare instances have sori been detected on the fronds of fossil ferns. Only one palm was submitted to the experiment, and it withstood the immersion tolerably well. Now, as a considerable portion, if not all the coal strata, appears to have been deposited at the bottom of lakes or seas, it will be seen that before they would become covered to

any depth with the deposits which form what is termed shale, a considerable time would elapse, and during this time the more evanescent species would entirely perish, while those which were better able to withstand the decomposing action of water would be imbedded in the mud, and remain as records of some of the then existing races of plants.

Proceeding upward from the coal strata, we find it stated, on the authority of count Sternberg, that palms existed during the period of the new red sandstone (*Permian* and *Trias*.) Their remains seem to be entirely absent from the oolite and lias, though the trunks and leaves of *Cycadeæ* (a nearly allied tribe) are very plentiful. In the Wealden strata of Tilgate forest, Hastings, and the Isle of Wight, Dr. Mantell has found the stems of a very curious plant, resembling the palm in structure, and associated with the bones of reptiles and fresh water shells.

But it is not till we arrive at the tertiary strata, that the remains of palms are found in any considerable quantity. Here, however, they are found in great numbers, especially in the lower and earlier tertiary strata—the Eocene period of Lyell. In the gypsum quarries of Montmartre, near Paris, fine specimens of a fan palm (*Flabellaria*) are met with, associated with

land and river shells, and the bones of birds and quadrupeds. A cotemporaneous bed is known in England as the London clay. This bed overlies a great part of Middlesex, (whence its name,) Essex, and Hampshire. The Isle of Sheppey is entirely composed of London clay, and is remarkable for the immense numbers of vegetable remains, together with those of crabs, turtles, crocodiles, snakes, and vultures, which are imbedded there. The vegetable remains are chiefly fruits, of which many hundred species have been collected. Among them are the fruits of no less than thirteen species of a palm, (*Nipadites*), nearly allied to the genus *Nipa*. *Nipæ* are low, shrub-like plants, having the character and aspect of palms, which grow in marshy tracts at the mouths of rivers in the Moluccas and Philippine Islands, particularly where the waters are brackish. They are allied to the cocoa nuts on the one hand, and to the *Pandani* or screw pines on the other. Species of cocoa nuts are also found imbedded in the London clay of Sheppey, as well as other kinds of palms. The fruits and seeds of various kinds of acacia also occur in profusion,—those of various species of the melon and gourd tribe; three species of *Anona* or custard apple, etc. Masses of fossil wood, also, accompany

these fruits, which are found to be portions of the trunks of palms, firs, and dicotyledonous trees. So abundant are these fruits at this spot that they may readily be collected in quantity. The cliffs, which are in some places two hundred feet high, are from their soft nature continually being undermined by the action of the waves; and as fresh portions are thus continually falling, their inclosed fossils are exposed on the beach. They are all of a blackish colour, partly from the clay in which they have been buried, and partly from being strongly impregnated with iron pyrites. In consequence of this latter circumstance, they generally decompose when allowed to remain exposed to the air, and fall to pieces. The best means of preventing this is to cover them, after being well wiped, with two or three coats of good varnish, which will effectually preserve them. The palm fruits are often five to seven inches long, and are commonly called petrified figs.

The facts we have now mentioned respecting the London clay evidently show that England, or what there was of it, must then have had a tropical climate; the whole character of the remains, both animal and vegetable, are tropical; and the perfect state of preservation in which multitudes of them are, will not allow us to sup-

pose that they were transported from any great distance before they found their final resting-places. Stems, leaves, and fruits of palms have been discovered in the tertiary strata by M. Adolphe Brogniart. Silicified trunks and fruits occur in many places on the continent, in Antigua,* and among mammalian remains in Ava and the Himalaya mountains. Stems of palms have also been found in the alluvial strata of the north of Europe, associated with the remains of elephants; their position, state, and appearance rendering it highly improbable that they have been drifted from any distance, much less from the tropics; and as these races are now almost exclusively tropical, we may consider it as a matter scarcely admitting of a doubt, (taking these facts in connexion with others before stated, and with numbers more of a similar character which might be adduced,) that our country once possessed a climate as warm as Italy or the North of Africa. It might not, perhaps, be necessary for the production of the phenomena cited, that the mean heat of the climate should be so high as that possessed by inter-tropical regions (the true palm lands) now; a somewhat lower temperature, if tolerably equalized as regards winter and summer, would probably suffice.

* Mantell's Medals of Creation, pl. v. fig. 1.

Sir Charles Lyell has advanced a beautiful theory, which shows that these changes of climate may be accounted for by reference to one cause, which is still in daily operation on our globe. It is well known to every one who is even but slightly acquainted with geological facts, that the land is not always that stable, fixed, and unalterable thing which it is usually looked upon as being. In various parts of the world, by some marvellous action of the internal forces of the earth, probably analogous to those which produce earthquakes, the land is raised up to a greater elevation above the sea-level, or it is depressed lower than before. And not only *has* this been the case, but it is a process continually going on, sometimes suddenly, but more often gradually and slowly, though certainly. Thus, in some parts of Norway the land has been slowly rising at the steady rate of about four feet in a century. In many parts of the southern ocean its bed is as certainly, yet slowly sinking; and coral islands that now are but just level with the water, will probably become a sunken reef of dangerous rocks. In South America the land has been rising, till what were once beaches are now great distances inland.* On one occa-

* See Darwin's "Natural History of the Voyage of the Beagle."

sion, the land was suddenly upraised seventy feet. In 1538, a tract of land was raised above the level of the sea in the Bay of Baïæ, near Naples, on which were still standing the remains of a temple which a former earthquake had plunged beneath the waters; and, at the present day, the land on which that temple stands has again sunk, so as to bring the temple almost again in contact with the waves. But we might multiply instances like these to a great extent, for they have been experienced and are traceable in every quarter of the globe.

It is also known that the structure of each part of the globe materially influences all adjacent parts. Thus, an island is of more equable temperature than a continent. A highly elevated and extensive tract of land in the Arctic regions, clad as it must be with the accumulated ice and snows of thousands of winters, exerts a chilling influence on the climate to a vast distance; and if unchecked by the modifying intervention of the ocean, it might carry a polar climate far into what are now considered as the temperate zones.* Thus, South Georgia, in the same latitude south as Yorkshire is north, but being in the southern hemisphere, is clad in perpetually frozen snow,

* "Geography of Plants," p. 170.

because the south polar region is a very elevated continent, rising in many parts into lofty mountain peaks. One of these, Mount Terror, is 10,880 feet, and another, Mount Erebus, 12,400 feet above the level of the sea, cooling down the adjacent region to a far greater degree than takes place in the northern hemisphere. The ice extends much further from the pole in the southern hemisphere than in the northern, and icebergs have been seen off the Cape of Good Hope, (about 35° south latitude.) We can easily perceive, therefore, that if a large tract of land near the north pole were considerably elevated above its present height, it would occasion a change in the climate of all the north of Europe and America. Suppose, for example, the bottom of the sea, which now intervenes between the north coast of Europe and the north pole, were to be raised so as to become dry land, elevated one thousand feet above the level of the sea, and at the same time a corresponding portion of the northern part of the continent of Africa were to be depressed below the sea-level, and the ocean were to occupy its place, the probable consequence would be the lowering of the temperature of the whole continent of Europe to such a degree as would change the climate of England to that of Iceland

or Lapland, fill our mountain valleys with glaciers, and our seas with icebergs. On the other hand, let us suppose that instead of the changes we have imagined, Greenland and Spitzbergen were to be so sunk that the waves of the ocean rolled over them, and that a corresponding portion of the ocean bed were raised so as to become dry land in the North Atlantic Ocean, in the neighbourhood of the tropic of Cancer, it would be difficult to estimate the full amount of the change which would be produced in the climate of our island. And this effect would be the more striking if some part of the continent of Europe were broken up into a cluster of islands. Palms, bananas, oranges, rice, and cotton might then be, doubtless, cultivated with advantage in England, so warm would the climate have become. The vine might revel in our woods as richly as it does in those of Armenia, and our native wines might rival the choicest productions of the south of Europe. Here, then, we conceive, is a most satisfactory solution (theory though it be) of this most singular and apparently difficult problem—that palms, bananas, cocoa nuts, and other tropical fruits, should once have owned our cold clime as their genial home.

And now, ere we close, we must survey, very briefly, some considerations which are suggested by the facts which have passed in review before us. We are accustomed to regard the land, the rocks, the mountains, "the everlasting hills," as some of the most stable and unalterable of created things; and yet we have just seen that the whole crust of this globe is perpetually oscillating, as it were, changing and being changed. When we couple with this the fact, apparently so well established, of the intense heat, and, probably, the fluidity of the internal portion of our globe, we see an agency ever present with us, fully adequate to produce, at any moment when God shall so will it, the awful event which is to terminate the present order of things, and the reign of sin on the earth; when "the heavens shall pass away with a great noise, and the elements shall melt with fervent heat, the earth also and the works that are therein shall be burned up." It is but the rupture of the shell—the skin of rock which covers this fiery ocean, and the catastrophe is accomplished. It is only His almighty power who says to the ocean, "Hitherto shalt thou come, but no further," that has kept those burning waves within their bounds till now. We see how continually we live, and move, and have

our being in Him ; that we are dependent, not merely on his upholding power in sustaining our life and breath, and in supplying us with food, but upon his restraining power in preventing those potent elements of evil which surround us on every hand, from overwhelming us with sudden destruction. And while we may, therefore, all most heartily unite with the psalmist in the grateful song of praise, " O give thanks unto the Lord ; for he is good : for his mercy endureth for ever," it becomes those who have not yet sought an interest in Christ, who have not yet fled for refuge to the hope set before them in the gospel, to beware lest the " great day of God's wrath " should overtake them while yet at a distance from him.

A second inference is still more plainly suggested, namely, the wonderful wisdom and goodness of God, as manifested in the adaptation of the palm tribe and its products to supply the wants and minister to the comforts of man. One of its most remarkable features in this respect is, the capability with which many species are endowed, of existing amid regions so arid as to preclude the possibility of the existence of almost any other vegetable. Yet, amid such sandy wastes, the date palm affords its grateful shade, and yields its delicious fruit ;

and by every spring, in some of those dreary and burning plains,

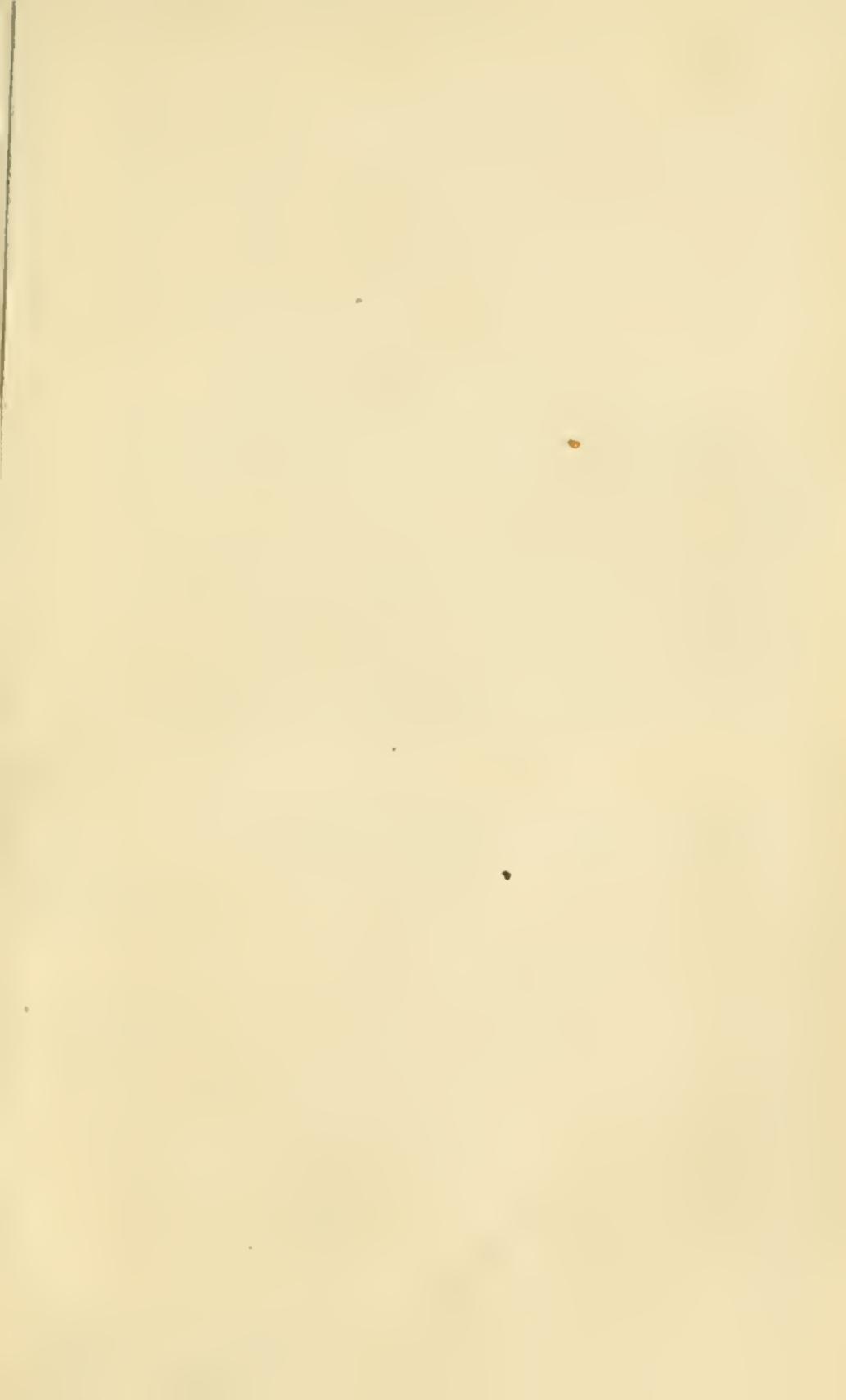
“Where herb, nor shrub, nor tree takes root,”

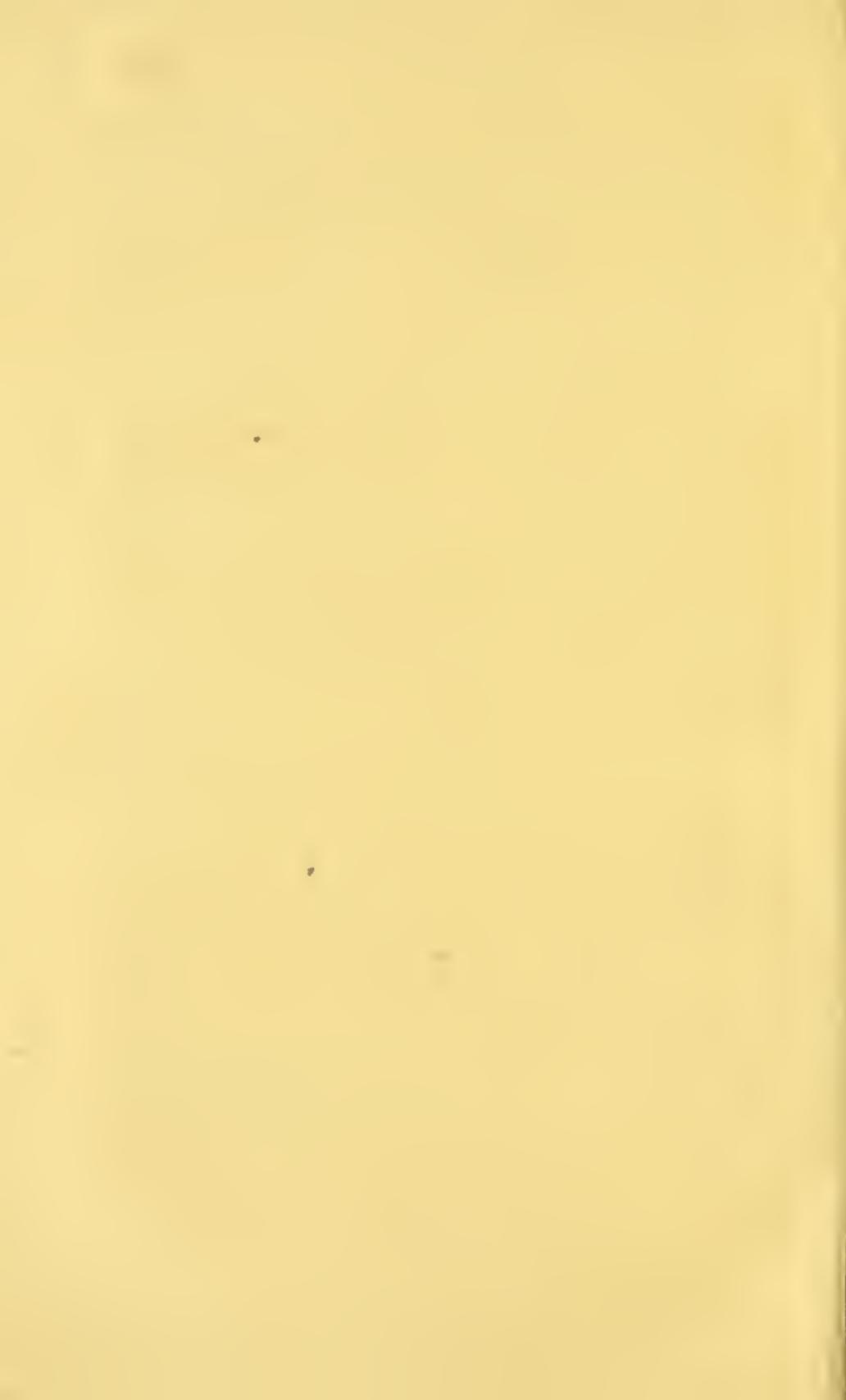
does its presence announce from afar the oasis, and manifest the proximity of water, while its shelter affords a screen for a tuft of verdure amid surrounding desolation. So in India, also, the sugar palm (*Phœnix sylvestris*) derives its rich, and luscious, and abundant juice, from spots so barren that they can scarcely support any other plant. The amazingly various and important uses of the palm tribe are perhaps unequalled, as a whole, by any other single section of the vegetable kingdom; and the provision of such abundant means of support for man in regions too hot for the greater part of the corn tribe, is one of those countless instances of the Divine benevolence and providence which the observant mind is continually meeting with. All the absolute necessities of life (except medicine) are provided for in the products of these remarkable trees,—food, clothing, shelter, and materials wherewith to manufacture an abundance of the most useful implements. Surely, in the review of the many facts of this kind which we have noticed, we may find abundant reason to praise Him who causeth the herb to grow “for the service of man: that he may bring forth

food out of the earth ; and wine that maketh glad the heart of man, and oil to make his face to shine, and bread which strengtheneth man's heart." He, indeed, "is good to all : and his tender mercies are over all his works," though we have sinned against him.

The recognition of the wisdom and goodness of the Divine Creator in these, the works of his hands, is not, however, all that we need feel ; these are owned by many who are yet strangers to him, as he is revealed in the Scriptures of truth. We must feel our lost and ruined state as sinners, our estrangement from God in consequence of our fallen nature, and the hopelessness of reconciliation by any works or righteousness of our own. We must feel deeply our entire unworthiness, and in the full sense of it, seek for pardon and salvation through that adorable Saviour who, by his death upon the cross, has purchased eternal redemption freely extended to all those who believe in him. It is by faith in him, and by that alone, that we can realize true peace ; and as the Holy Spirit sanctifies our hearts by his gracious influences upon them, and conforms us to the mind and will of God, so much the more shall we delight in God—in his works, both of nature and of providence, and of grace. We shall view with increasing

interest, delight, and thankfulness, the ever-accumulating manifestations of his wisdom, so marvellously displayed in the works of creation, equally in the minutest as in the greatest; we shall trace with devout admiration the indications of his providence, and with the highest and adoring gratitude, the wonderful display of all his perfections in the great scheme of salvation. But it will be reserved for another and a better world,—when we shall be freed from those hindrances which at present cloud our sight and hide so much of God's ways from our view,—when the range of our intellect, now so limited and contracted, shall be vastly enlarged,—fully to unfold before us the wonders of the Divine government. There may we unite in the devout contemplation of these “parts of his ways,” as yet so imperfectly understood, with those who, having come off conquerors in the strife with sin and Satan, through him who loved them, stand “before the throne, and before the Lamb, clothed with white robes, and PALMS in their hands;” and cry “with a loud voice, saying, Salvation to our God which sitteth upon the throne, and unto the Lamb.”





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