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ROYAL BOTANIC GARDENS, KEW.

BULLETIN

OF

MISCELLANEOUS INFORMATION.

ADDITIONAL SERIES, VI.

SELECTED PAPERS

FROM THE

KEW BULLETIN.

II.—SPECIES AND PRINCIPAL VARIETIES OF MUSA.

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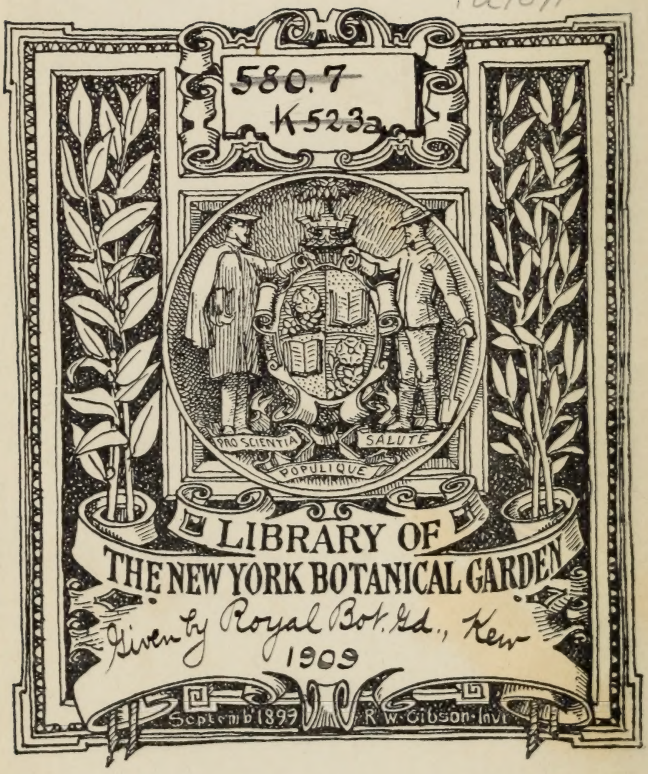
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SPECIES AND PRINCIPAL VARIETIES OF MUSA.

[*K.B.*, 1894, pp. 229–314.]

The tribe *Museæ* forms a part of the important Natural Order SCITAMINEÆ, which includes numerous economic plants such as Arrow-root, Turmeric, Cardamoms, Ginger, and Cannas. It embraces four genera, all of interest:—*Heliconia*, *Musa*, *Strelitzia*, and *Ravenala*. The Heliconias are natives of the New World, and represent in habit the wild Musas of the Old. The Musas themselves include the wild and cultivated bananas and plantains, and are indigenous to the Old World and Polynesia. The Strelitzias are plants with distichous leaves, and their flowers are large, white, blue, or orange coloured; they are restricted to South Africa. The Ravenalas, two species only, are found in such widely-separated countries as Madagascar and Guiana. They are the well-known "Travellers'-palms," whose leaves on long stalks arranged like the ribs of a fan are striking objects in many tropical countries.

Musas are the largest of tree-like herbs, often attaining, with the leaves, a height of 25 to 40 feet. They have not inappropriately been compared by Meneghini and Achille Richard to "gigantic leeks." These plants can be grown over an immense area of the earth's surface, and are found either wild or cultivated from 38° N. lat. to 35° S. lat.

There are about 40 described species of *Musa* known (in various parts of the world) and about one-half of these are now under cultivation in this country. The edible-fruited species seem to have migrated with mankind into all the climates in which they can be grown, and are universally cultivated in the equatorial zone for purposes of shade and food. Le Maout and Decaisne say:—

"Bananas and plantains afford such desirable food that their cultivation is not less important in the tropics than that of cereals and farinaceous tubers in temperate regions."

In West Africa, Monteiro (*Angola and the Congo*, I., 294) speaks thus of these plants:—

"Bananas and plantains grow magnificently where the rich moist earth in which they delight is found, . . . and they rear their magnificent leaves unbroken by a breath of air. A grove of banana trees thus growing luxuriantly in a forest clearing is one of the most beautiful

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sights in nature ; the vast leaves reflecting the rays of the hot sun from their bright green surface contrast vividly with the dark-hued foliage of the trees around, and show off the whorls of flowers with their fleshy, metallic, purple-red envelopes and the great bunches of green and ripe yellow fruit."

Burton passed through groves of cultivated plantains in Central Africa during "a whole day's march" ; while Johnston in Eastern Africa regarded "the groves of emerald green bananas everywhere met with as marking the commencement of the cultivated region."

Belt's observations in the New World are :—

"The banana tree shoots up its succulent stem and unfolds its immense entire leaves with great rapidity ; and a group of them waving their silky leaves in the sun, or shining ghostly white in the moonlight, forms one of those beautiful sights that can only be seen to perfection in the tropics."

An excellent general account of the plantain and banana was given by the late Professor Lindley in *Trans. Roy. Hort. Soc.*, V., pp. 83–84 :—

"The plantain or banana, with which as a tree no one can be unacquainted, is the principal fruit consumed by the inhabitants of the torrid zone ; and from its nutritious qualities and general use may, whether used in a raw or dressed form, be regarded rather as a necessary article of food than as an occasional luxury. In equinoctial Asia and America, in tropical Africa, in the Islands of the Atlantic and Pacific Ocean, wherever the mean heat of the year exceeds 75° Fahr., the banana is one of the most interesting objects of cultivation for the subsistence of man. The fruit is produced from amongst the immense leaves in bunches weighing 30, 60, and 80 lbs., of the richest hues, and of the greatest diversity of form. It usually is long and narrow, of a pale yellow or dark red colour, with a yellow farinaceous flesh. But in form it varies to oblong and nearly spherical ; and in colour it offers all the shades and variations of tints that the combination of yellow and red, in different proportions, can produce. Some sorts are said always to be of a bright green colour. In general, the character of the fruit to an European palate is that of mild insipidity ; some sorts are even so coarse as not to be edible without preparation. The greater number, however, are used in their raw state, and some varieties acquire by cultivation a very exquisite flavour, some of them surpassing the finest pear. In the better sorts the flesh is no harder than butter is in winter, and has much the colour of the finest yellow butter. It is of a delicate taste, and melts in the mouth like marmalade. To point out all the kinds that are cultivated in the East Indies alone would be as difficult as to describe the varieties of apples and pears in Europe ; for the names vary according to the form, size, taste, and colour of the fruits."

Besides the fruit-yielding Musas there are many species so ornamental that they are surpassed by few plants admired for their gigantic stature and graceful foliage. The largest of these is the Abyssinian *Musa Enseie*, first described by the traveller Bruce. The leaves in fine specimens are nearly 30 feet long and about 3 feet wide. The smallest species is a singularly interesting one recently discovered by Delavay in Western China (*Musa lasiocarpa*). There is no apparent stem and the leaves are only about a foot long. Between these two extreme forms there are numerous intermediate ones, all graceful and attractive, some with bright red flower-bracts. Others, again, remarkable for their mottled or banded leaves, are cultivated for their beauty. In spite of their value as food plants and their wide distribution, Musas have not

by any means been studied carefully, and there is no standard work existing giving an adequate account of their history, origin, and distribution in various parts of the world. The information respecting them is scattered through numerous books which are seldom accessible except in large libraries. A paper on *Les differentes espèces dans le genre Musa* (Bananier), by Dr. Sagot, was published in the *Journal de la Société Nationale d' Horticulture de France*, April and May, 1887. Dr. Sagot divided the Musas (or Bananas as he called them) into three groups as follows :—

1. The Giant Bananas, of which *M. Ensete* is the type. In this group no suckers are formed. The fruit is inedible and leathery, seeds few.
2. Fleshy-fruited Bananas, with *M. sapientum* as the type. Stem producing suckers ; spike long and decurved ; fruit fleshy and usually edible.
3. Ornamental Bananas. Spike often erect, not pendent, bracts persistent, brightly coloured, each with only a few flowers in its axil, suckers many, fruit leathery. *M. rosacea* and *M. coccinea* are familiar examples of this group.

More recently, in 1893, *A Synopis of the Genera and Species of Museæ*, prepared by Mr. J. G. Baker, F.R.S., was published in the *Annals of Botany*, Vol. VII., pp. 189–222. This contains a key to the sections and species and brief descriptions of 32 species of *Musa* and several varieties. Mr. Baker's paper brings together, for the first time, a complete review of the genus, and a starting point is established from which to make further investigations. The chief features in it are incorporated here. The sub-generic distinctions adopted by Mr. Baker are based on the shape of the stem, the number of flowers to a bract, the shape of the petal, and the colour of the bract. His divisions, like those of Sagot, are three, and they practically include almost the same species.

Descriptive.

The **stem** (pseudo-stem) in Musas usually arises from a perennial rootstock which is made up of a number of successive shoots extending outwards from the original base. The apparent stem arising from each shoot is composed at one stage of nothing but the convolute sheaths of the leaves. The sheaths of the leaves in this case are tightly packed one over another, and the outermost generally covers about three-fourths of the circumference. The inner sheaths, occupying the centre, are very narrow and tightly rolled, but they gradually widen as they come nearer the outer surface of the stem. When the plant is about to flower the bud, which starts from the base, is pushed up through the centre of the leaf-sheaths and appears at the top from among the expanded leaves.

Graham (*Bot. Mag.*, t. 3849) had carefully noticed the growth of the flower-bud of Musas in this country in 1840. He says :—

"The flower-bud, as I have proved by cutting down full-grown plants of *Musa rosacea* and *Cavendishii*, and I think also of *M. paradisiaca*, remains at the root till a time after the plant has attained its full size, varying according to its treatment, and then pushes its way upwards—

PLANTAIN.

Musa sapientum var. *paradisiaca*,

its appearance at the top of the stem being preceded by the evolution of one or more leaves smaller than the rest."

Observations on this point have been made lately at Kew. (1.) A stem of *M. sapientum*, about 12 months old, was cut down before flowering when nearly, but not quite, fully grown. The whole stem was 15 feet high. Cut longitudinally, it showed at the base a conical body rising in the centre about 8 inches above the attachment of the outermost leaves. From the apex of the cone the flower bud had already started. It was on a slender leafless stalk about an inch in diameter. The bud itself was found about 4 inches higher. In this case it had evidently just begun to grow. (2.) In a plant of *M. Basjoo*, apparently fully grown, the conical axis was 10 inches in diameter at the base, invested at that point by a few leaf-sheaths. A foot higher with the stem of leaf-sheaths 9 inches in diameter, the flower stalk was an inch and a half in diameter. By carefully following it, the top of the flower bud was found at 3 feet from the base, forming a club-shaped body easily recognised by a bulging out of the innermost leaf-sheaths. Here the flower bud was found about one-third of the way up the stem. (3.) Finally a stem of *M. sapientum* that had already borne fruit was examined. It was about 12 feet high. At a foot above the conical base the fruiting stalk, cut through, was one and three-quarter inches in diameter. It preserved the same diameter and was traced as a slender, white, fibrous body, over 12 feet high, closely invested by the leaf-sheaths, until it emerged from amongst the petioles of the leaves. It then became coloured green and curved downwards.

These observations fully confirm what has just been quoted from Dr. Graham. They show that the rate of growth of the flower bud must be very rapid. In the tropics where the whole plant matures and ripens its fruit within 12 months, the flower bud probably takes only a few weeks to push its way from the base to the top of the stem. From the time of flowering until the fruit is ripe takes about six to eight weeks. In the non-stoloniferous species the whole plant is strictly monocarpic, and reproduces itself not by shoots but by seeds.* The majority of species are, however, reproduced by buds or shoots which spring from the perennial rootstock.

The shape of the pseudo-stem varies a good deal. In one section the stems are bottle-shaped, having a swollen distended appearance. This is very noticeable in *M. superba*. Usually the stem is cylindrical, gradually tapering from the base upwards. In *M. Ensete* the stem is 6 to 10 feet high, and very stout. In *M. Hillii* it is about 30 feet high, and moderately stout only. Again, in *M. Mannii*, it is only 2–3 feet high and 1 inch in diameter.

The stems of most species are green, with occasional blotches of black, red, or purple. Those in the banana (*M. sapientum*) are often described as green and "purple spotted"; while in the plantain (variety *M. paradisiaca*) they are said to be wholly "green." These characters are, however, not constant. The stem of *M.* (*sapientum*) *dacca* is "pruinose," and appears covered with glittering particles of fine dew. In *M.* (*sapientum*) *rubra* the stem is dull-red, while the interesting *M Fehi* has a greenish stem with violet juice.

* Kurz, however, remarks that even in non-stoloniferous species shoots are occasionally produced. "I remember," he says, "a plant of *Musa glauca* in the Botanical Gardens at Java, which threw out two shoots; and if accounts be correct *M. Ensete* is said to make shoots if the whole plant is cut down before flowering."

The **leaves**, arranged in a loose rosette, are large, oblong, and entire, with a very prominent midrib, and numerous straight, transverse veins. The free portion of the petiole may be long or short. Usually the leaves are bright green on both sides, sometimes darker above and glaucous beneath, rarely with a narrow red edge. In the young state the leaves have narrowly hyaline margins, either beautifully crimson or white. The midrib is semi-cylindrical below, with a deep rounded groove above. The blades on each side of the midrib are generally flat, but sometimes hang down. The large leaves of *M. Ensete* have been already noticed, the petiole is short, broad, deeply channelled. The midrib is red. In *M. Cavendishii* the leaves are arranged in a dense rosette, and are rather glaucous. The petiole is short and stout, with two broad, crisped, green edges. The leaves in *M. discolor* are glaucous, tinged with violet or red. In *M. Fitzalani* they are patent; in *M. rosacea* linear-oblong, and tinged with purple beneath. *M. zebrina* has the leaves barred with purple; *M. (sapientum) vittata* barred with white; and *M. sumatrana* with irregular blotches of claret-brown.

From the centre of the leafy envelopes at the top of the pseudo-stem emerges the flowering **spike**, which tapers very slightly upwards. Only the uppermost part of it becomes exserted from the leaf-crown, and it is often furnished here with comparatively diminutive cauline leaves, which more or less abruptly pass into the floral bracts. This spike varies greatly in size and length, not only with the species, but according to soil and treatment under cultivation.

It is composed of many clusters of flowers arranged at intervals along the rachis. Each cluster is subtended by a large spathaceous and membranous bract. The lower part of the rachis, or the peduncle, is as often shortly tomentose or puberulous as it is glabrous, and such variations, according to Kurz, occur in the same variety. It is also furrowed, although the furrows are often obsolete. In some species the spike is erect, as in *M. Fehi*. In *M. discolor* it is drooping, and as long as the leaves. In *M. proboscidea* it is nearly as long as the pseudo-stem (5–6 feet).

The **bracts** are most conspicuous and large in all species of *Musa*. They are important in the discrimination of species. They entirely cover the half-whorls of flowers, and are so densely laid one upon the other that they form a sort of flower cone, which the Malays call *djantong*. The lowermost bracts are always larger and more elongate, and bear usually no flowers in their axils. The nature of the outside of the bracts, whether furrowed and variously pruinose to mealy, or smooth and glossy to almost polished, furnishes good distinctive characters. The colour, too, is of value, although great variations occur. The enormously large bracts of *M. Ensete*, 1½ to 2 feet long, are claret-brown and persistent. In others they fall off with the abortive flowers. *M. sapientum* has bracts of a dull violet colour more or less glaucous outside. In one section (*Rhodochlamys*) the species have very highly coloured bracts, generally red or yellow. *M. salaccensis* has pale lilac bracts, while in *M. coccinea*, a very ornamental species, they are bright red, tipped with yellow; in *M. aurantiaca* they are bright orange.

The **flowers**, arranged in half-whorls, are inserted upon crescent-shaped protuberances of the rachis. They are usually arranged in two rows and subtended by the bract. The lowermost clusters of flowers are generally female or pistillate (or as Kurz describes them hermaphrodite-female) as the stamens are reduced or absent. The whorls further along

the rachis have staminate or male flowers (hermaphrodite-male) as, although the pistil is present and smaller, it is not functional. In a general sense the lowermost flowers are said to be female and the upper male flowers. Hence it is only the lowermost flowers, near the base, that produce fruit, and the normal state is to have only a few fruit-whorls at this part, while the male-hermaphrodite flowers and their bracts drop off successively leaving a warted nude rachis, terminating in a flower cone formed by the innermost bracts of the male flowers. Fertilization in bananas is probably effected by the action of the wind; the pollen is spherical and smooth. In *M. Ensete*, Kurz describes the pollen grains as tubercled. In many cases the conditions are favourable to self-fertilization, especially when the whole spike consists of hermaphrodite flowers. Under glass it would no doubt be an advantage to fertilize the flowers artificially, as thereby a more abundant crop of fruit would be produced. and rare species preserved. This was successfully done at Kew in regard to *M. Ensete* in 1860, and repeated with other species later. Cross fertilization also might be effected in order to produce new varieties. It is possible that in the natural state this has influenced varieties to a larger extent than is supposed.

There is a tendency to abnormal parts in the flowers of Musas, but usually they are as follows :—

The *calyx* at first tubular, is soon slit down on one side, and 3–5 toothed at the apex. The *petal*, placed opposite the calyx, is simple or tricuspidate. The *stamens* are normally six, but one is usually suppressed : in the others the anthers are two-celled and basifixed. *Ovary* cylindrical, three-celled; ovules many in a cell, superposed; style filiform from a thickened base; stigma shortly lobed.

The **fruit** is a berry, elongate or short, pulpy or dry, angular, oblong, or cylindrical. The sharpness and distinctness of the corners of the fruit depend upon the amount of pressure to which they are subjected in the whorls. Consequently the angles are sharper where the fruit whorls are more crowded and compact. On the other hand, where the fruits are very loosely disposed they are more rounded or terete.

Seeds, when produced, are sub-globose or angled by pressure, often excavated at the hilum. The testa is very hard, intruded at the base and apex; albumen mealy, the embryo sub-truncate.

There is great variety as regards the size, shape, colour, and texture of the fruit. In one section (*Physocaulis*) the fruit is always coriaceous or leathery, with numerous large sub-globose angled seeds. In the pulpy or edible-fruited species the fruit, when ripe, may be smooth or rough, opaque or glossy, yellow or reddish; or it may be bright yellow, violet, tinged with blood red, straw-yellow, yellowish red, yellowish green, or white. It may be from 3 to 10 or even 18 inches long, oblong, cylindrical, or indistinctly angular, sometimes with a blunt end or sometimes produced, as in the singular "duck plantain" of the Malays, with a beak nearly as long as its body. It may be shortly stalked, sessile or produced at the end of pedicels 2 or 3 inches long. In the section *Rhodochlamys* only one species (*M. maculata*) produces edible fruit, the others have small dry fruit, filled with seeds, and not edible. In *M. velutina* the fruit is velvety and bright red, in *M. lasiocarpa*, pubescent, with 4–6 seeds filling up the whole cavity.

In the pulpy or edible-fruited species, known as bananas or plantains, the fruits are arranged in clusters. Some stand straight out; others are slightly curled outwards and upwards; while not a few are

quite recurved pointing upwards parallel with the rachis and overlapping each other. Again, the fruits may be loosely arranged, hardly touching one another; or they may be compactly or even densely crowded together so as to completely hide the rachis. The Jamaica banana, for instance, has the fruits "compactly but not densely arranged, recurved, almost parallel with the axis." In the Surinam banana the fruits "are laxly arranged, the first series somewhat re-curved, the rest spreading nearly at right angles to the axis." In the Chinese or dwarf banana the fruits "are lax, spreading outwards, hardly overlapping." The plantains (the vegetable) have generally fewer and looser fruits. These may be "laxly spreading outwards" or "curled upwards like a horn." The individual fruits are usually larger than in the banana, the pulp firm and the colour yellowish-green, or yellow when ripe, not red.

The fruit clusters are called "hands." Each hand may vary from 3 to 10, or in exceptional instances to 18, on each spike. Again, a hand may consist of 8 to 18 single fruits or "fingers." The total number of fruits produced on a "bunch" may be as low as 24, or as high as 250 or more. The weight of a bunch may be from 30 to 90 pounds.

After fruiting the stem dies. Its place is however taken by several new shoots or stolons thrown up from the base. These grow closely together, and the next year two or three may bear bunches of fruit. When once planted the produce of banana trees on a small area is exceptionally large. Hence Humboldt has calculated that, although less nutritious than wheat or potatoes, yet the space occupied by their culture and the care required render the produce of bananas compared to wheat as 123 to 1, and to that of potatoes as 44 to 1.

The bananas (using the word in a general sense) are amongst those cultivated plants of which we know the wild stock; we are also acquainted with one or more intermediate forms between the wild and cultivated so that the transition in the evolution of the pulpy fruit without seeds from the dry fruit full of seeds can be observed. In the case of *M. Fehi*, found wild in Tahiti, Fiji, and New Caledonia, according to Dr. Sagot well-formed seeds are not very common, and hence this species exhibits even in the wild condition a tendency to abortion of the seeds and a compensating hypertrophy of the pulp. Musas in a wild state are chiefly found in India, the Malay Archipelago, Cochin-China, Philippines, Northern Australia, and the Islands of the Pacific. A remarkable group of large species with swollen stems and leathery fruits are found in Africa. The true bananas are apparently Indian, Malayan, and Polynesian. They have been cultivated from the earliest times, and the facility with which suckers can be transported, and the long period during which they retain their vitality, have rendered them particularly easy of distribution. There are no plants that require less care to establish.

The most familiar of cultivated Musas are those originally described by Linnæus as *M. sapientum* and *M. paradisiaca.*

Species of Musa.

Although it has usually been believed that only one or two species of *Musa* yield edible fruit it will be found that besides the numberless varieties of *M. sapientum*, including the common bananas or plantains of tropical countries, there are several other species which are cultivated

Musa Ensete, Gmel.
(*Botanical Magazine*, t. 5223.)

for their fruit, and not a few that are grown for other purposes, such as yielding an edible rootstock or for the sake of the tender flower bud eaten as a vegetable. The most widely cultivated species next to *M. sapientum* is *M. Cavendishii*, the dwarf or Chinese banana, introduced to Europe within the last 50 years. Then, according to Kurz, a large proportion of the best varieties of plantains cultivated in the Malay archipelago are derived from *M. acuminata*. A very palatable fruit with violet pulp is yielded by *M. discolor* in New Caledonia. *M. Fehi* has an erect fruiting spike, and the fruit, when cooked is universally used in the Pacific Islands. Lastly, *M. maculata* with a yellow fruit spotted with brown, known only as cultivated in Mauritius and Bourbon under the name of *Figue mignonne*, has an aromatic white pulp. The rhizome of *M. oleracea* is boiled or roasted like a yam ; and the inner bud of *M. Ensete* is a source of food supply in Abyssinia. In some form or other, however, every species of *Musa* is of economic importance and the numerous uses to which they are put in various parts of the world are only equalled possibly by the palms and bamboos.

The three sub-genera into which *Musa* is divided by Mr. Baker are as follows :—

1. Sub-genus **Physocaulis** (Swollen-stemmed Musas).—Stem bottle-shaped and usually not stoloniferous. Flowers many to a bract. Petal usually tricuspidate. Fruit not edible. In this group are all the species known to be indigenous to Africa, namely : *M. ventricosa*, *M. Buchanani*, *M. livingstoniana*, and *M. proboscidea*. Of Asiatic species Mr. Baker gives two, *M. superba* and *M. nepalensis*. The latter said to be from the "lower hills of Nepal" has not been found since the days of Wallich and is quite unknown at the present time.
2. Sub-genus **Eumusa** (true Musas).—Stem cylindrical, gradually tapering from the base, usually stoloniferous. Flowers many to a bract. Petal ovate-acuminate. Bracts green, brown, or dull violet. Fruit usually edible. The species in this group divide naturally, according to their height, into dwarf-stemmed and tall-stemmed species. The dwarf are two Chinese species, *M. lasiocarpa* and *M. Cavendishii*. The tall are *M. sapientum* and its allies, about a dozen species in all. They are widely distributed throughout Eastern Asia, India to China, and Japan, Borneo, New Guinea, North Queensland, and the Islands of the Pacific.
3. Sub-genus **Rhodochlamys** (red-bracteated Musas).—Stem cylindrical as in true Musas, usually stoloniferous. Flowers few to a bract. Petal linear. Fruit usually not edible. Bracts bright coloured, often red. Twelve species are included here. One only (*M. maculata*) yields edible fruit. The others, such as *M. coccinea*, *M. rubra*, *M. velutina*, and *M. aurantiaca*, owing to their brightly coloured bracts, are very ornamental. All are from India, Assam, Sumatra, Java, and Cochin-China.

Key to the Sub-genera and Species of Musa.

Sub-genus PHYSOCAULIS, *Baker*. Stems short, bottle-shaped. Male flowers many to a bract. Fruit not edible. Usually not stoloniferous.

Seeds few, large (about an inch broad) :

Male flowers 15–20 in a row.

Petal tricuspidate - - - 1. *M. Ensete.*

Petal ovate, entire - - - 2. *M ventricosa.*

Male flowers, about 10 in a row - - 3. *M. Buchanani.*

Seeds many, comparatively small :

African :

Hilum of the seed deeply depressed, surrounded by prominent edges - 4. *M. livingstoniana.*

Hilum of the seed, but slightly depressed - - - - 5. *M. proboscidea.*

Indian :

Flowers 10–15 in a row; bracts sub-orbicular, claret-brown - - 6. *M. superba.*

Flowers 7–8 in a row; lower bracts ovate, dull lilac - - - 7. *M. nepalensis.*

Sub-genus EUMUSA, *Baker*. Stems cylindrical. Male flowers many to a bract. Fruit generally edible. Usually stoloniferous.

Dwarf species, with short petiole :

Membranous yellow bracts and pubescent fruit - - - - 8. *M. lasiocarpa.*

Bracts firmer ; fruit glabrous :

Stem very short ; many upper flowers sterile - - - - 9. *M. Cavendishii.*

Stem longer ; flowers all fertile - 10. *M. nana.*

Tall species, with long petiole :

Petal small, tricuspidate - - - 11. *M. glauca.*

Petal ovate, entire :

Fruit narrowed into a beak :

Fruit many, smaller - - 12. *M. acuminata.*

Fruit few, larger - - 13. *M. corniculata.*

Fruit not narrowed into a beak :

Spike dense, erect or sub-erect :

Fruit not edible, ovoid - 14. *M. Hillii.*

Fruit edible, oblong - - 15. *M. Fehi.*

Spike drooping :

Fruit with a long distinct stipe - - - - 16. *M. Banksii.*

Fruit with a short distinct stipe - - - - 17. *M. Fitzalani.*

Fruit sessile, or sub-sessile :

Leaves firm in texture, yielding good fibre 18. *M. textilis.*

Leaves not firm in texture, yielding poor fibre :

Leaves smaller, glaucous - - 19. *M. discolor.*

Leaves, larger, green :

Petal as long as calyx - 20. *M. Basjoo.*

Petal shorter than calyx :

Rachis of spike pubescent :

Bracts brown outside - 21. *M. malaccensis.*

Bracts yellow outside - 22. *M. flava.*

Rachis of spike glabrous - 23. *M. sapientum.*

Sub-genus RHODOCHLAMYS, *Baker*. Stems slender, cylindrical. Male flowers few to a bract. Fruit not generally edible. Usually stoloniferous.

Fruit edible ; bracts yellow-brown - - 24. *M. maculata.*

Fruit not edible :

Leaves large ; fruit distinctly stipitate - 25. *M. sumatrana.*

Leaves smaller ; fruit not distinctly stipitate :

Bracts pale or dark lilac :

Petal shorter than the calyx - 26. *M. violascens.*

Petal nearly or quite as long as the calyx :

Flowers yellow - - 27. *M. rosacea.*
Flowers greenish - - 28. *M. salaccensis.*

Bracts red :

Fruit hairy - - - 29. *M. velutina.*
Fruit glabrous :

Petal nearly or quite as long as the calyx :

Bracts crimson - - 30. *M. coccinea.*
Bracts pale red - - 31. *M. rosea.*
Bracts blood-red - 32. *M. sanguinea.*

Petal much shorter than the calyx :

Bracts bright red - 33. *M. rubra.*
Bracts pale red - - 34. *M. Mannii.*
Bracts bright orange - 35. *M. aurantiaca.*

Sub-genus Physocaulis.

Swollen-stemmed Musas.

[An asterisk is prefixed to those species and varieties of which examples are in cultivation at Kew.]

*1. **Musa Ensete**, *Gmel.* Abyssinian Banana. Native name "Ensete." *Bot. Mag.*, t. 5223–4. North Gallery, No. 516. Whole plant 30–40 feet high. Stem swollen at the base, not stoloniferous. Leaves oblong acute, sometimes 20 feet long and 3 feet broad with a red midrib. Bracts densely imbricated 9 to 12 inches long, dark claret brown. Fruit coriaceous, dry, 2 to 3 inches long. Seeds 1–4 black, glossy, nearly an inch broad with a prominent raised border round the hilum. *Distribution* :—Mountains of Abyssinia to the hills of equatorial Africa ; southward of Victoria Nyanza Lake. The largest known banana. The flowers of a specimen that flowered at Kew in 1878 are preserved in the Kew Museum ; also a series of seeds from Abyssinia (Plowden) ; Nyanza Lake (Kirk) ; prepared fibre from stem from Abyssinia (Plowden), Jamaica (Morris), and a specimen grown at Kew.

It was discovered by the traveller Bruce and is remarkable as being represented on ancient Egyptian sculptures. Plants growing in the

cool climate of the Blue Mountains in Jamaica at 4,000 feet are described by Mr. Morris (*Native and other Fibre Plants*, 1884, p. 38) as having "leaves 20 feet long; the stem about 8 feet in circumference at the base, with a height of 30 feet; the total weight of a single plant was not less than a quarter of a ton." An illustration of the Jamaica plant is given in the *Gardeners' Chronicle*, 1881 [1], p. 435. This species is well adapted for sub-tropical countries such as South California, Florida, Algeria, and Canary Islands, and is often put out for the summer in the London Parks. When established in sheltered situations it is a very ornamental plant having a noble and majestic habit. The fruit is useless for purposes of food. As the plant produces no offsets and perishes after fruiting it is propagated entirely from seed.

*2. **M. ventricosa**, *Welw.* Whole plant 8 to 10 feet high. Stem much swollen, 4 feet in diameter at the base. Leaves oblanceolate-oblong, 4 to 5 feet long, thick in texture, with a pale-red midrib. Differs from other species of this section by its entire petal. Fruit like that of *M. Ensete*. Seeds large, dull black with a broad hollow at the hilum. *Distribution*:—found in Angola, province of Pungo Andongo, in rocky places near rivulets 10° S. lat. by Welwitsch. *M. africana*, Bull. Cat., is probably this species in a young state; as also a plant lately received at Kew from St. Petersburgh under the same name. Seeds of this species are in the Kew Museum.

3. **M. Buchanani**, *Baker*. Nearly allied to *M. Ensete*, but the bracts are linear-oblong, 1–1½ feet long, 2½–4 in. broad. Flowers 10 in a row. Seeds as large as those of *M. Ensete*, glossy, black, not tubercled. Dried specimens only received from Mr. John Buchanan, C.M.G., from the Shiré Highlands, East Africa, 1885.

4. **M. livingstoniana**, *Kirk*. Stem conical, twice the height of a man, 2–3 feet diameter at the base. Leaves narrow oblong, crowded, as long as the trunk, with a short, broad-clasping, deeply channelled petiole. Fruit many seeded 4 inches long. Seeds globose, angled by pressure in the lower half, ⅓ inch diameter, dull brown tubercled with a depressed hilum, surrounded by prominent edges. Described from sketches, notes, and seeds brought from south-east tropical Africa by Sir John Kirk, G.C.M.G. *Distribution*:—Between 12° and 19° S. lat. in region of Lake Nyassa. A necklace of similar seeds is in the Kew Museum sent from Sierra Leone by Barter. This species has once been under cultivation at Kew, but is probably unknown in Europe at the present time. *Kew Bull.* 1894, pp. 225–226.

5. **M. proboscidea**, *Oliver*, in *Hooker's Icon. Plant*, t. 1777. Trunk dilated at the base, reaching 4–5 times the height of a man. Leaves narrow oblong, very large, narrowed to the base; free petiole, short, deeply channelled. Spike finally drooping, very much elongated, nearly as long as the stem; bracts broad, ovate, obtuse, about 4 times as long as the flowers; flowers in two close rows of about 12 in a row. Petal very short with two orbicular outer lobes, and a large linear central cusp. Seeds turbinate, black, glossy, ½ inch broad and long, with only a small hollow at the hilum. *Distribution*:—Known from seeds and four photographs in the Kew Museum procured by Sir John Kirk, G.C.M.G., from the Hills of Ukami, about 100 miles inland from Zanzibar. *Kew Bull.*, 1894, pp. 225–226.

*6. **M. superba**, *Roxb. Bot. Mag.*, t. 3849–50. Whole plant reaching a height of 10–12 feet. Trunk not stoloniferous, much dilated, 7–8 feet in circumference at the base, narrowed to 3 feet below the leaves. Leaves oblong, narrowed to the base; free petiole, very short, deeply channelled. Spike at first globose, a foot in diameter, finally drooping, a third the length of the trunk; bracts orbicular, dull claret-brown, reaching a foot in length and breadth; flowers in two dense rows of 10–15 each. Petal short, tricuspidate, with a large linear central cusp. Fruit oblong, sub-coriaceous, 3 inches long, $1\frac{1}{2}$ inches diameter. Seeds very numerous, sub-globose, angled by pressure, $\frac{1}{3}$–$\frac{1}{2}$ inch diameter, smooth, brown. *Distribution*:—Western Ghauts of the Bombay Presidency. Native name at Nasik, *Chavai*. According to Dr. Ritchie, this species is stemless on rocks in the Rama Ghauts. Fruits are in the Kew Museum from Travancore (1874) and Trivan-

Musa superba, Roxb.
(Whole plant greatly reduced.)
1. Pistillate flower. 2. Staminate flower. 3. Fruit. 4. Cross section of fruit.

drum (1875). A fibre from "Jungle plantain (*M. superba*)" is shown from Mangalore, the chief town of South Kanara, in the Madras Presidency, and from the Botanic Gardens, Mauritius, Col.-Ind. Exhibition, 1886.

7. **M. nepalensis**, *Wall.* This is principally known from two large unpublished drawings by Wallich now at Kew. It is not anywhere in cultivation. Dr. King, F.R.S., in a letter dated Calcutta 22nd August 1893, writes :—"I do not believe in the existence of the species which Wallich called *M. nepalensis*. I have never been able to hear of, or find, any specimens of a big non-stoloniferous plantain on the lower slopes of the Himalaya. I have made inquiries in Nepal where Wallich says it grows. Wallich must have described Roxburgh's *M. glauca* under the name *nepalensis*."

Subgenus Eumusa.

True Musas.

8. **M. lasiocarpa**, *Franchet.* A singular species only about 1–2 feet high, known by the Chinese of Yunnan as *Ngay-tsiao* (Rock banana).

Musa lasiocarpa, Franchet.

1. Whole plant (2 feet high) much reduced. 2. Section of rhizome surmounted by persistent portions of leaf-sheaths. 3. Fruit with seeds. 4. Flower. 5. Calyx. 6. Petal.

The rhizome is 2–3 inches in diameter and crowned with successive frills of the lower persistent leaf-sheath. The small petioled leaves rise almost directly from the ground. The spike is erect, very dense, with prominent bracts. The fruit is dry, pubescent on the outside, hence the name, and contains 4–6 seeds. This interesting plant is regarded by Franchet as the type of a new section called *Musella*. It is remarkable for the absence of a stem, the pubescent character of its fruit, the dense form of the inflorescence, the persistency of all the bracts, and the complete absence of pulp in the fruit. The Abbé Delavay discovered the plant in 1885 in the mountainous regions of Yunnan on the rocks of Loko-chan and Che-tong near Tapin-tze, at an elevation of 4,000 feet. He states that it is easy of cultivation, and he has grown it in his garden for four years, but had not flowered it. *Journ. de Bot.*, vol. iii. (1889), pp. 329–331.

*9. **M. Cavendishii**, *Lamb.* M. chinensis, *Sweet* (name only); North Gallery, Nos. 225, 816; M. sinensis, *Sagot.* Stoloniferous. Whole plant 4–6 feet high; leaves 6–8 inches in a dense rosette, spreading, oblong, 2–3 feet long, about a foot broad, much rounded at the base, rather glaucous; petiole short, stout, deeply channelled, with two broad crisped green edges. Rachis short, stout. Spike dense, oblong, 1–2 feet long, drooping; bracts red-brown or dark brown, ovate, the lower 6 inches long, the upper 3–4 inches; male flowers and their bracts persistent. Petal ovate, entire. Fruit as many as 200–250 to a panicle, oblong, 6-angled, slightly curved, 4–5 inches long, above 1½ inches diameter, obtuse, narrowed gradually to the sessile base, seedless, edible, with a rather thick skin and delicate fragrant flesh. *Distribution*:—Native of Southern China. Cultivated in Mauritius, and introduced to England in 1827. This is now extensively cultivated in all tropical and sub-tropical countries and known as the "Chinese or Dwarf" banana. It furnishes a large proportion of the bananas usually sold in this country. The wild seed-bearing form is not yet known. *M. Massoni*, Sagot (name only), supposed to be wild at the Gaboon and cultivated in Bourbon, is said to be like *M. Cavendishii*, but with slightly different fruit. The interesting story of the introduction of the Chinese banana to the islands of Polynesia is thus told by Seemann (*Flora Vitiensis*, p. 289):—

"An important addition to their stock of bananas the Fijians received in the *Vudi ni papalagi* (*i.e.*, foreign banana), our *Musa chinensis* or *Cavendishii*, which the late John Williams, better known as the Martyr of Eromanga, brought in a wardian case from the Duke of Devonshire's seat at Chatsworth to the Samoan or Navigator Islands, whence again, in 1848, the Rev. George Pritchard carried it to the Tongan or Friendly Islands, as well as to the Fijis. Its introduction has put an effectual stop to those famines which previously to this event were occasionally experienced in some of these islands. Never attaining any greater height than 6 feet, and being of robust growth, the Cavendish banana is but little affected by the violent winds which cause such damage amongst plantations of the taller kinds of *Musa*; and this advantage, coupled with its abundant yield and the fine flavour of its fruit, have induced the natives to propagate it to such an extent that, notwithstanding its comparatively recent introduction, the *Vudi ni papalagi* numbers amongst the most common bananas of the country." A sample of fibre from the stem of *M. Cavendishii* is in the Kew Museum, from Jamaica, prepared by Nathaniel Wilson.

10. **M. nana**, *Lour.* Trunk cylindrical, 5 feet long, ½ foot diameter, leaves oblong-ovate, 3 feet high; spike short, recurved; flowers all

fertile. Stamens often six or more. Fruit ovate-oblong, edible, seedless. According to Loureiro this is a native of Cochin-China, where it is called *Chuoi duii*. It is, however, unknown to M. Pierre. Mr. Baker thinks it may be a form of *M. Cavendishii*, Lamb, with a taller stem and staminate flowers abortive. *M. Rhinozerotis*, of Kurz, said to be like *M. nana*, but with all the sheaths of the leaves enveloping one another, and with persistent bracts and flowers all fertile, is unknown at Kew.

11. **M. glauca**, *Roxb.* Not stoloniferous. Trunk cylindrical, 10–12 feet high, 6–8 inches diameter. Leaves oblong-lanceolate, acute, 4–5 feet long, pale and glaucous; shortly petioled. Spike drooping from the base; bracts greenish, persistent. Fruit oblong, 4–5 inches long, 1½ inches diameter; truncate at the apex, narrowed gradually to the sessile base. Seeds smooth, globose, nearly black, ½-inch diameter. Pegu; introduced to the Calcutta Botanical Garden by Mr. F. Carey in 1810. This has flowers like *M. superba*, and a cylindrical trunk like *M. sapientum*. Roxburgh in his *Coromandel Plants*, iii. 96, adds, "Like my *M. superba* it never produces suckers, consequently it must be reared from seed, which it furnishes in great abundance; the fruit containing little else, even fit for a monkey to eat."

12. **M. acuminata**, *Colla* (M. simiarum, *Rumph*); M. rumphiana, *Kurz*. Stem high, cylindrical, stoloniferous at the base. Leaves oblong, 5–6 feet long, glaucous beneath, deltoid at the base, firmer than those of *M. sapientum*; petiole 1-1½ feet long, almost without any membranous edge. Spike drooping, shorter than the leaves; male flowers deciduous; bracts lanceolate or oblong-lanceolate, violet, only one of those of the female flowers opened at once and revolute, those of the male clusters involute at the edge. Calyx white or yellowish, 1–1¼ inches long; petal ovate-acuminate, nearly as long as the calyx. Fruit in 4–6 clusters of 10–12 each, oblong, rostrate, 2–4 inches long, 1–1½ inches diameter; skin not easily peeled off; flesh sweet. Seeds dull black, angled by pressure, ⅛ inch diameter. *Distribution*:—Common in Java and the other Malay islands extending eastward to New Guinea. Kurz, who studied this species carefully on the spot, says that a large proportion of the bananas which are cultivated in the Malay Archipelago are derived from it, and that its best varieties are superior to all those derived from *M. sapientum* in quality and delicacy. Typical *M. acuminata* is wild and has fruit full of seed. From this several seedless cultivated varieties are derived, differing in the colour of the leaves and fruit. They all have the leaves glaucous beneath, and in one form the waxy bloom is so copious that torches are made from it. Var. *violacea*, Kurz, has its stems, leaves and flowers more or less tinged with dark purple, and purple 3–5 angled fruit with a thick beak. Its native name is "pisang teembaya" or "pisang hoorang" (copper or crab plantain). Var. *culta*, Kurz, is larger in all its parts, with much larger whitish or yellowish flowers, and longer cylindrical or angled yellow or greenish seedless fruit. Of this there are 48 distinguishable forms, of which the most curious is the Duck plantain ("pisang moolook bebbek"), the fruit of which has a beak nearly as long as its body. Baker refers here *M. paradisiaca*, Zollinger. Probably *M. Berteri*, Colla (M. alphurica, *Rumph*), which has green and leaf-like lower bracts and pale yellow ripe fruit a span long, is a variety of this species. Nothing is known of *M. Karang*, Kurz, of which the fruit is said to be angular, short, and thick-beaked, and the bracts yellow inside.

13. **M. corniculata** (*Rumph, Amboin.* V. 130), *Lour. Fl. Cochinch.* 644; native name in Cochin-China, *Chuoi boi.* Stem cylindrical, 10–12 feet high, as thick as the human thigh. Leaves oblong, green, 5–6 feet long; petiole 1–1½ feet long. Spike drooping, only the 2–3, rarely 4 lower bracts and flower whorls developed, the former oblong-lanceolate, a foot long. Calyx deeply five-toothed. Petal ovate-acuminate, nearly as long as the calyx. Fruit cylindrical, a foot or more long, 1½–2½ inches diameter, narrowed gradually to the apex and sessile base, golden-yellow when ripe; skin thick; pulp reddish-white, firm, dry, sweet, very palatable when cooked. *Distribution:*—Malay Islands and Cochin China. Kurz compares the fruit to a cucumber as regards shape and size and describes five varieties, but considers it to be probably only an extreme form of *M. acuminata.* A curious form is the Lubang variety, of which the stem is said to produce only a single fruit large enough for a full meal for three men.

*14. **M. Hillii**, *F. Muell.* Not stoloniferous. Stem robust, about 30 feet high and a diameter of 1½ feet. Leaves similar to *M. sapientum.* Spike dense, erect. Fruit densely crowded, not edible. Seeds numerous, angled, much depressed ⅕–⅓ inch diameter, with a bony testa. *Distribution:*—Queensland, banks of the Daintree river, with the two species following. A plant at Kew resembles *M. troglodytarum*, Linn. No doubt this is *M. Jackeyi*, Kurz, l.c. This species has lately flowered at Kew. [*Bot. Mag.* t. 7401.]

*15. **M. Fehi**, *Bertero;* M. Fei, *Nadeaud.* Stoloniferous. Trunk cylindrical, 15–20 feet high, greenish, full of violet juice. Leaves larger and firmer in texure than in *M. sapientum* and *paradisiaca*, with stouter veins; midrib green; base unequally rounded; petiole 1–1½ feet long. Spike long, erect, slightly curved only at the base. Flowers 6–8 in a cluster, sessile. Calyx with 5 unequal lobes, split finally nearly to the base. Petal short. Fruit many in a bunch, oblong, angled 5–6 inches long by above an inch in diameter, nearly straight, yellow when ripe, with a thick skin and moderately firm pulp, not very palatable when raw, but excellent when cooked. Seeds small, dull black. *Distribution:*—Common in the forests of Tahiti, where it is largely used for food, seedless at the low levels, but occasionally bearing seeds at an altitude of 3,000–3,600 feet. Native name *Fei.* Found also sparingly by Vieillard in New Caledonia, there called *Daak.* We have young plants at the present time in the Kew collection. Probably the Fijian *M. Seemanni*, F. Muell, of which a photograph, sent by Sir John Thurston, is reproduced here from *Gard. Chron.*, 1890 [2], 182, fig. 28, is the same species. This is *M. uranoscopos*, Seem., and *M. troglodytarum*, Kurz (in part). We have also leaves from the Rev. T. Powell of a plant from Samoa called "Laufoo," which probably belongs here. An interesting account of the seedless and seed-bearing forms of *M. Fehi* is given by Dr. Sagot in *Bull. Soc. Botanique de France*, xxxiii., pp. 317–326.

16. **M. Banksii**, *F. Muell;* M. banksiana, *Kurz.* Stoloniferous, with trunk like that of *M. sapientum.* Spike drooping. Fruit quite cylindrical when dry, without any angle, narrowed suddenly to a slender stipe 1½-2 inches long. Seeds grey, sub-globose, ⅛ inch diam., angled in the lower half. *Distribution:*—Queensland, Mount Elliot and Rockingham bay. Very like *M. sapientum* in stem and leaf, but totally different in fruit. It yields a fibre of poor quality. A sample received from Mr. W. R. Guilfoyle, F.L.S., is in the Kew Museum, where the fruit (from Sir F. von Mueller) and seeds (from Mr. L. A. Bernays, C.M.G.) are also shown.

Musa Seemanni, F. M.
From *Gardeners' Chronicle*, 1890 [2], fig. 28.

17. **M. Fitzalani**, *F. Muell.* Stem 20 feet high. Leaves patent. Spike drooping. Fruit oblong, angled, yellow when ripe, not pulpy, 2–3 inches long, narrowed suddenly to a thick stipe about $\frac{1}{2}$ inch long. Seeds numerous, filling the cells, angular, depressed, scarcely $\frac{1}{6}$ inch in diameter. Queensland. *M. Charlioi*, Walter Hill, in Report of the

Brisbane Garden, 1874, is said to have stems 40–50 feet high, leaves 5–6 feet long, and fruit 3–4 inches long.

*18. **M. textilis**, *Née*; (M. mindanensis, *Rumph*); M. sylvestris, *Colla*; M. troglodytarum textoria, *Blanco*. Stem cylindrical, green, 20 feet or more high, stoloniferous from the base. Leaves oblong, deltoid at the base, bright green above, rather glaucous beneath, smaller and firmer in texture than those of *M. sapientum*; petiole a foot long. Spike drooping, shorter than the leaves; male flowers deciduous; bracts firmer in texture than those of *M. sapientum*, naked and polished outside, not at all pruinose, brown. Female flowers in several laxly-disposed clusters. Fruit green, oblong trigonous, curved, 2–3 inches long, 1 inch diameter, not narrowed to the apex, but narrowed to the short stout stipe, not edible, but filled with seed. Seeds black, turbinate, $\frac{1}{6}$ inch diameter, angled by pressure. *Distribution*:— Widely distributed and cultivated in the Philippine Islands under the name of *Abaca*. It ascends the mountains in the wild state to the lower limit of *Pinus insularis*. It is cultivated (at elevations of 200 feet to 500 feet) for the sake of its cordage fibre, one of the most valuable known for the manufacture of white ropes. The plant has been introduced to other tropical countries, but, so far, it has not succeeded anywhere so well as in the Philippines. (*Kew Bull.*, 1887, April, pp. 1–3.)

Var. *M. amboinensis*, Rumph. Stem not so tall. Spike not so drooping. Fruit as long as a man's finger, black at maturity. Native of Amboyna.

A very complete set of specimens of fruit (Ceylon), seeds (Manila), of prepared hemp, cords, ropes, mats, plaited work, hats, lace handkerchiefs from *M. textilis* are shown in the Kew Museum. Dried specimens of the inflorescence of this species are desired for the Kew Herbarium; while a portion of the spike preserved in spirit would be a valuable addition to the Museum.

*19. **M. discolor**, *Horan*. Stoloniferous. Stem slender, cylindrical, 6–10 feet high. Leaves narrow-oblong, smaller and firmer in texture than in *M. sapientum*, rounded at the base, glaucous, tinged with violet or red beneath when young; petiole a foot or more long. Spike drooping, finally as long as the leaves; bracts reddish, the upper only persisting; male flowers deciduous. Fruit cylindrical, angled, rather curved, umbonate at the apex, rather dry, reddish-violet, very palatable, with a violet pulp, and a rather musky scent. *Distribution*:—This species is cultivated in Polynesia and especially in New Caledonia, where it bears the name of *Colaboute*, and is said by Vieillard to be wild there. It produces no fertile seeds. It is in cultivation in this country and there is a drawing at Kew by Fitch of a plant that flowered in the Gardens many years ago. The stem yields a textile fibre which is used for fish-baskets, &c.

*20. **M. Basjoo**, *Sieb.* et *Zucc.*; *Bot. Mag.* t. 7182; M. japonica *Hort.* Stoloniferous. Stem cylindrical, 6–9 feet high, 6–8 inches diameter. Leaves oblong, thin, bright green, 6–9 feet long, $1\frac{1}{2}$–$2\frac{1}{2}$ feet broad, deltoid at the base; petiole stout, about a foot long. Rachis stout, arcuate, a foot long. Spike dense, 1–$1\frac{1}{2}$ feet long; female

clusters 3–4, close, of 12–15 flowers each; bracts oblong, dull brown, the lower 8–12 inches long; male clusters 8–12, their bracts much imbricated, persistent. Calyx whitish, 2 inches long, shortly five-toothed at the tip. Fruit oblong-trigonous 3 inches long, umbonate at the apex, narrowed gradually to the sessile base. Seeds not seen. *Distribution*:—Liu Kiu archipelago (25° to 30° N. lat.); cultivated in Southern Japan. Introduced into cultivation in England by Messrs. Veitch of Chelsea. Described from a plant that flowered in the Temperate House at Kew in 1891. It is said to be as hardy as *M. Ensete*. It is grown in Southern Japan for its fibre. An interesting series of articles made from this "Japanese plantain," consisting of fibre, cloth and other fabrics, is in the Kew Museum, presented by Mr. J. H. Veitch, F.L.S. The cloth is used for making screens, and for binding books.

**M. Martini*, Rev. Hort. Belg. 1892, 107, fig. 12, has the habit of *M. sapientum*, and is said to be more hardy than *M. Ensete*, with bright rose-red flowers. The leaves are oblong, long petioled, firm in texture, bright green above, glaucous beneath with reddish veins. A plant which has not yet flowered exists in the Kew collections brought from the Botanical Garden, Orotava, Teneriffe, by the Assistant Director in 1893.

21. **M. malaccensis**, *Ridley*. Stems few, slender, 6 inches diameter, with purple-brown blotches. Leaves about 8 feet long, green with brown bars. Spike drooping, clothed with brown hairs; bracts lanceolate, sub-acute, brown, outside glaucous, inside striped with yellow. Female flowers 16 in a bract in a double row. Fruit sub-cylindrical, somewhat angular, 4 inches long, an inch wide; seeds black, angular; "pisang karok" of the Malays. *Distribution*:—Common in the jungles of Malacca, Selangor, and Perak, occurring also in Pahang.

"*M. zebrina* (Flore des Serres, t. 1061, 1062) is doubtless," according to Ridley, "a young plant either of this species or of *M. sumatrana*, Becc. I never saw," he says, "any form of *M. sapientum*, L. (to which species Mr. Baker refers this) with barred leaves. The brown bars are very constant in young plants of *M. malaccensis* and even persist sometimes in the adult foliage. This species may perhaps be the parent of some of the cultivated bananas here, but is very distinct from *M. sapientum* in the hairy rachis and other points . . . An attempt has been made to utilise the fibre. The plant is very abundant and springs up like a weed when old jungle is felled and forms an impenetrable thicket."

22. **M. flava**, *Ridley*. Leaves 16 inches wide, green. Spike nodding, pubescent; bracts widely ovate lanceolate, obtuse, 4 inches long, 1½ inches wide, yellow. Female flowers 16 to a bract in two rows. Fruit, when dry, 2 inches long, five angled. *Distribution*:—Eastern coast of the Malay Peninsula, Pahang at Pulau Tijau on the Pahang River.

Nearly allied to *M. malaccensis*, but the broad, thick, blunt, bright yellow bracts give it a totally different appearance, the spike being quite blunt at the top.

* **Musa** sp. Hongkong. No. 467, 1886. A plant of a *Musa*, native of Hongkong, supposed to be new, was received from Mr. Charles Ford, F.L.S., in 1886 and again in 1894. It is now growing at

Kew but it has not yet flowered. It has a slender stem and rather small leaves. The flowers, judging by dried specimens, are those of *M. sapientum*.

*23. **M. sapientum**, *Linn. Sp. Plant.* 1477 ; *Trew, Ehret.* t. 21–22. Stem cylindrical, usually green, reaching a height of 20–25 feet, 4–10 inches diameter, stoloniferous from the base. Leaves oblong, thin, bright green, 5–8 feet long, 1½–2 feet broad, usually rounded at the base ; petiole 1–1½ feet long. Spike drooping, often 4–5 feet long ; male flowers deciduous ; bracts lanceolate or oblong-lanceolate, dull violet, more or less glaucous outside, the lower 1–1½ feet long, the upper ½ foot, often red inside, several expanded at once, the edges of the upper not involute. Flowers about a dozen to a cluster, yellowish-white, 1½ inches long ; calyx five-toothed at the top ; petal ovate, half as long as the calyx. Fruit oblong-trigonous, 3–8 inches long, 1½–2 inches diameter, forming three to nine bundles of about a dozen each, rounded to the apex, narrowed gradually to the sessile base, yellow or bright yellow or reddish when ripe, the flesh fit to eat without cooking. Common banana. Universally cultivated throughout the tropical zone of both hemispheres for the sake of its fruit. It also yields a fibre, which, however, is much inferior in tenacity to that of *M. texilis*.

One of the original forms of this is probably the wild *M. sapientum* mentioned by Roxburgh (*Corom. Pt.* t. 275) as grown from seed received from Chittagong.

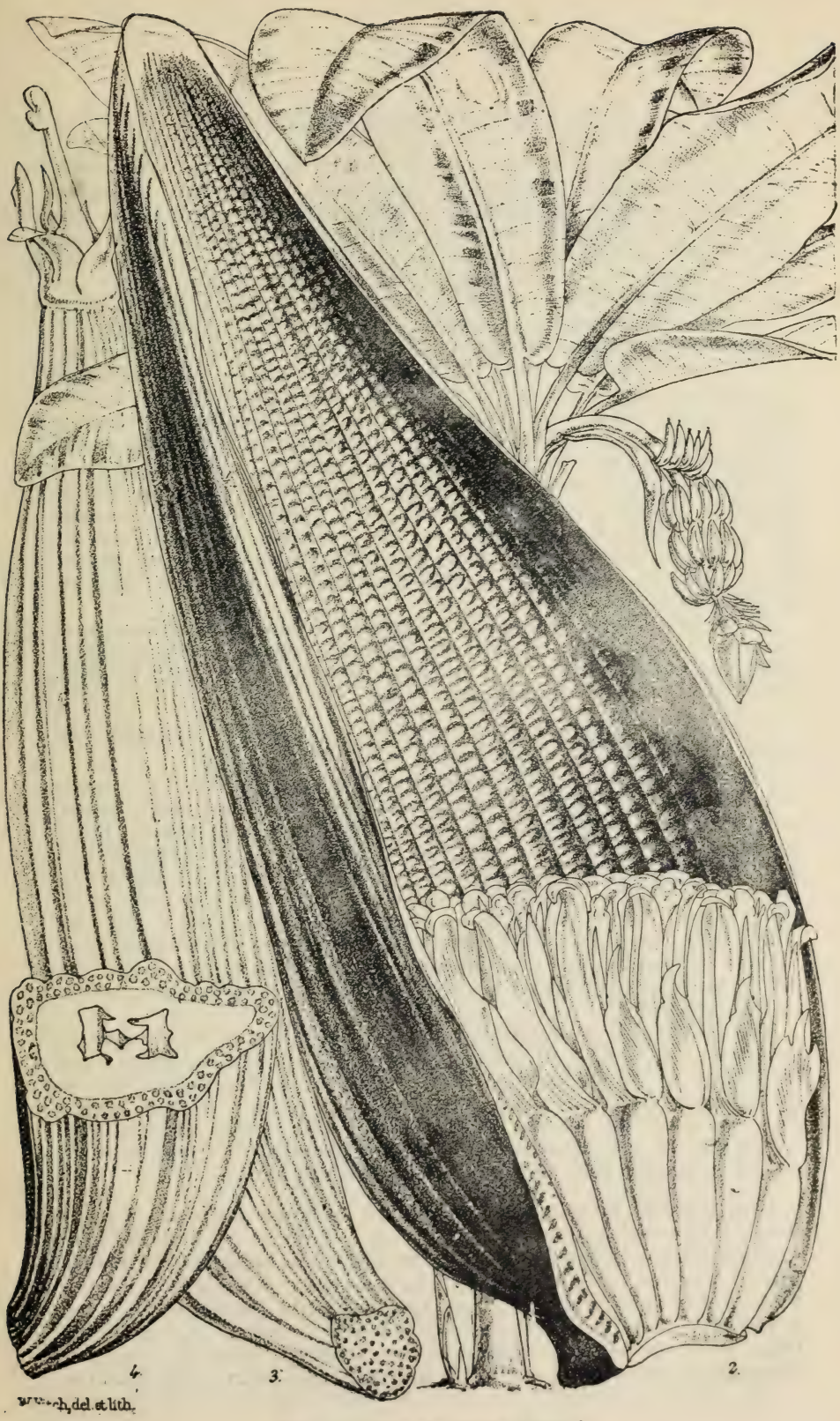
*Var. *M. paradisiaca*, Linn. Sp. Plant. 1477 ; Trew, Ehret. t. 18–20. Male flowers and bracts less deciduous. Fruit cylindrical, ½–1 foot long, generally yellow or yellowish green when ripe with firmer and less saccharine pulp, not fit to eat without cooking. Common plantain. Cultivated universally in the tropical zone.

Var. *M. troglodytarum*, Linn. ; M. uranoscopos, *Rumph.* Fruit small, crowded on the erect axis of the panicle, obovoid-oblong or nearly round, reddish-yellow, containing rudimentary seeds. Flesh sweet, yellow. Wild in India, Ceylon (Moon), and the Malay Isles, the favourite food of elephants. The above names have often been applied to forms of other species than *sapientum*, with a similar habit, such as *M. Fehi*.

Var. *M. oleracea*, Vieill. A flowerless form with a glaucous violet stem and an elongated thick turnip-like rhizome, which is boiled or roasted like a yam, which it resembles in taste. New Caledonia. Native name *Poiete*.

*Var. *M. vittata*, Hook. in *Bot. Mag.* t. 5402 ; M. vittata, *Ackerm*, in *Flore des Serres*, t. 1510–1513. Leaves and long fruits copiously striped with white. Spathes bright red inside. Imported from the island of St. Thomas, West Africa.

Other varieties to which Latin names have been given are : *M. violacea*, Hort ; *M. sanguinea*, Welw. ; *M. odorata*, Lour. ; (*M. mensaria*, Rumph) ; (*M. regia*, Rumph) ; **M. champa*, Hort. ; **M. martabanica*, Hort. ; **M. dacca*, Horan. ; **M. rubra*, Firminger, non Wallich.



Musa sapientum var. *vittata*, Hook. f.
(*Botanical Magazine*, t. 5402.)

1. Plant in fruit reduced. 2. Bract and hermaphrodite flowers. 3. Unripe fruit. 4. Transverse section of same.

Plantain and Banana.

The sweet bananas by many authors are referred to *Musa sapientum* and the vegetable-like fruits or plantains to *M. paradisiaca* There are, however, no characters that can be clearly defined as separating the two. Roxburgh, who paid particular attention to both the native and cultivated bananas and plantains of India, pronounces both to be varieties of one species found wild in the hilly districts of East Bengal, and which he calls *M. sapientum.* R. Brown (Tuckey's *Congo*, App. 471) states "there is no circumstance in the structure of any of the states of the banana or plantain cultivated in India or the islands of equinoctial Asia to prevent their being all considered as merely varieties of one and the same species, namely, *Musa sapientum;* that their reduction to a single species is even confirmed by the multitude of varieties that exist ; by nearly the whole of these varieties being destitute of seeds ; and by the existence of a plant indigenous to the continent of India producing perfect seeds ; from which, therefore, all of them may be supposed to have sprung." Loureiro (*Fl. Coch.* 792) says the same thing ; as does Desvaux (*Journ. de Bot.* (1814) Vol. IV. p. 5). Sir William Hooker (*Bot. Mag.* tab. 5402) states that the flowers of the bananas and plantains cultivated at Kew afford no character to distinguish them.

As to question of origin, A. de Candolle, following R. Brown, is of opinion that all evidence hitherto available points to "a primitive existence in Asia, and to a diffusion contemporary with or even anterior to that of the human race."

Alphonse de Candolle (*Cult. Plants*, pp. 306–308) discusses the origin and distribution of the banana as follows :—

"The antiquity and wild character of the banana in Asia are incontestable facts. There are several Sanscrit names. The Greeks, Latins, and Arabs have mentioned it as a remarkable Indian fruit tree. Pliny speaks of it distinctly. He says that the Greeks of the expedition of Alexander saw it in India, and he quotes the name *pala* which still persists in Malabar. Sages reposed beneath its shade and ate of its fruit. Hence the botanical name *Musa sapientum.* Musa is from the Arabic *mouz* or *mouwz*, which we find as early as the thirteenth century in Ebu Baithar. The specific name *paradisiaca* comes from the ridiculous hypothesis which made the banana figure in the story of Eve and of Paradise."

Again, "there is an immense number of varieties of the banana in the south of Asia, both on the islands and on the continent ; the cultivation of these varieties dates in India, in China, and in the Archipelago, from an epoch impossible to realise ; it even spread formerly into the islands of the Pacific, and to the west coast of Africa ; lastly, the varieties bore distinct names in the most separate Asiatic languages, such as Chinese, Sanskrit, and Malay."

The probable introduction to eastern tropical America is thus summed up :—

"The culture of the banana may be said to be recent in the greater part of America, for it dates but from little more than three centuries. Piso says positively that it was imported into Brazil, and has no Brazilian name. He does not say whence it came. According to Oviedo, the species was brought to San Domingo from the Canaries. This fact and the silence of Hernandez, generally so accurate about the

useful plants, wild or cultivated, in Mexico, convince me that at the time of the discovery of America the banana did not exist in the whole of the eastern part of the continent."

At the present time the plantain and banana are extensively cultivated in the tropics of the New World, and they have become as conspicuous a feature in the landscape as in the Old World, freely propagating by suckers and often found half wild in the forests.

With regard to Polynesia, Seemann remarks (*Flora Vitiensis*, p. 288) that "a great many different kinds of *Musa* were found established in different parts of cultivated Polynesia, when Europeans first became familiar with them. In Tahiti alone, Banks and Solander saw 28."

Sagot states that the wild banana most allied to the cultivated, and from which, therefore, it may be presumed to have originated, has the same height and habit. The spike is pendent towards the earth; the fruits are smaller, more distant from one another, and contain several fertile seeds. It also produces offsets from its rootstock. It occurs in some of the forests of India, notably at Chittagong (Roxburgh, *Fl. Ind.* i. 663), in Ceylon (Thwaites' *Enum.*, p. 321), in Cochin China, Siam especially, in the small island of Pulo Ubi (Finlayson), in the Philippines (Rumph and Blanco). Sagot adds: "I am unable to say if it is the same plant that is scattered over this vast area, or if there are several distinct species belonging respectively to the different countries."

In some countries, as in India, Ceylon, Mauritius, and Cochin China, bananas are cultivated with fruits containing several fertile seeds, which appear to belong to a wild form as yet slightly modified by cultivation.

The BANANA or SWEET PLANTAIN (*Musa sapientum*, Linn.). This is the sweet fruit used without cooking, it has various names in different parts of the world. The old voyagers called it "bonano." In the time of Roxburgh the Hindu or Bengali name for the banana was "kulla." Usually amongst Europeans in India the word "plantain" is used in a general sense for both the banana and plantain. Latterly, however, even in India, a distinction has been made in regard to the size and delicacy of the fruit, the small being the banana and the large the plantain. The Spaniards of tropical America call the banana "bacove," "bacooba," or "pacooba," while in other Spanish countries varieties of the banana are known as "cambur," or "camburi," or "platano guineo." The English in the West Indies call the small and delicate bananas "fig-bananas," or simply "figs." The French call the banana "bananes des sages," or "figue banane." In the Malay Archipelago, *pisang*, always translated "plantain," is used for both bananas and plantains. The variety known as "pisang maas," or the golden pisang, appears to come nearest to the banana as known elsewhere.

One of the earliest accounts of the banana and plantain is given by Ligon in his *History of Barbados*, published in 1657. In this work there are two wood cuts, drawn, as the author states, "by memory only," showing the habits of the two plants and the fruit. Of the "bonano" he says "it is of sweeter taste than the 'plantine,' and for that reason the negroes will not meddle with it, for it is not so useful a food."

Dampier's description, published in his *Voyages*, some years later, is more exact :—

"The *bonano* tree is like the plantain for shape and bigness, nor easily distinguishable from it but by its fruit, which is a great deal smaller, and

not above half so long as a plantain, being also more mellow and soft, less luscious, yet of a more delicate taste. They use this for the making drink oftener than the plantains, and it is best when used for drink, or eaten as fruit ; but it is not so good for bread, nor doth it eat well at all when roasted or boiled, so 'tis only necessity that makes any use it this way."

Rochefort (*Hist. Nat. des Isles Antilles*, pp. 90–93, ed. 1658) refers to the banana as *la figue*. He describes it as "only half the size of the plantain, and usually about 6 inches long. The tree bears 100 to 126 fruits, which are so closely packed that they press upon one another."

Lunan, in 1814, introduces a distinction first noticed by Ligon that the stem of the banana "has here and there some blackish spots." He says :—

"The banana tree so much resembles the plantain as hardly to be distinguished at first sight, but has its stem irregularly marked with black or dark purple spots, which the other has not. The bunches of fruit are more compact, and the fruit more numerous, shorter, and rounder than that of the plantain. The fruit has also a thinner skin, and the pulp is softer and of a more luscious agreeable taste when ripe, which may be eaten either raw, fried, or boiled, and makes excellent fritters. It is a delicate food when ripe and roasted with the skin on."

Grisebach, in the *Flora of the British West India Islands*, p. 599, describes the stem of the *M. sapientum* as "purple-spotted," and the fruit 5 to 6 inches long. Sir William Hooker, judging from plants grown at Kew, believed the leaves of the banana to be more rounded or cordate than those of the plantain. A further distinction often cited is the fact that the male flowers and bracts are deciduous in the banana leaving the spike beyond the fruit usually naked. In the plantain the male flowers and the bracts are persistent, and the spike beyond the fruit is clothed, not naked. The chief distinction, however, dwelt upon is the difference in the character of the fruit. This in the banana is always sweet when ripe, and it is fit to eat without cooking. Further, some sorts of banana are found to bear a cooler climate than the plantain.

The PLANTAIN or COOKING BANANA (*Musa sapientum* var. *paradisiaca*). This was recognised by Roxburgh under the Hindu and Bengali name of "katch kuila." It is the "large or cooking plantain" of Europeans in India, the Spanish "platano arton," the "banane" of French Guiana and Surinam, according to Aublet; while Rochefort, already cited, speaks of it as "le bananier." He adds, "It is 12 to 13 inches long and nearly as thick as the arm. The tree bears only 25 to 30 fruits on the raceme and these are rather laxly placed. They have a hard and dry flesh fit only for cooking or for being roasted in ashes." It is the sort typically represented by the "pisang tandok" of the Malays. Ligon in 1657 called it "plantine." This shows the antiquity of the common name amongst the English. Plantain was evidently originally derived from the Spanish name "plantano," altered by Joseph Acosta and subsequent writers into "platano." "Plantain," as remarked by Kurz, was an awkward introduction into the English language, as it was already applied to the common Rib-grass, a species of *Plantago*. Kurz, it may be added, contrary to general practice, in the East discarded the word "plantain" altogether,

and in his writings used the word "banana" exclusively, for the edible fruit of Musas.

Grisebach describes the stem of the plantain as "green" and the fruits "ascending" (or curved upwards) "about a foot long." This curving upwards is characteristic of the Horn plantain, but it is not distinctive enough to separate plantains and bananas in general. The prevailing habit of the leaves, according to Sir William Hooker, is that they are "much longer and narrowed into the petiole" than in the banana. The male flowers and the bracts are not so deciduous as in the banana, and the portion of the spike beyond the fruit is much shorter and usually covered with the remains of the bracts and dried up flowers. The individual fruits again are very distinct. They have a firmer and less saccharine pulp and are not fit to eat without cooking.

In a "Report on the Agricultural Work in the Botanical Gardens, British Guiana," for the year 1890, pp. 59–60, Messrs. Harrison and Jenman state that only after a long and well-trained experience can the plantain be distinguished in the field from the banana when not in flower or fruit.

"When in fruit, however, the case is different. There is then a character, observable at sight, which only requires to be pointed out for the merest novice in the subject to be able to tell which is which. This character is that, in the banana, after the fruit has set and begun to develop, the succeeding clusters of flowers, often a hundred or more in number, and their large embracing bracts are deciduous, *i.e.*, drop away, leaving a clear, absolutely naked, long extended and still elongating, stem or axis, hanging tail-like 2-3 feet beyond the fruit, with the firmly compacted mass of unopened bracts and flowers, bud-like at the end; while in the plantain the stem ceases to extend more than 12 or 18 inches beyond the fruit, the succeeding clusters of flowers and bracts all opening to the very end, and remaining persistent, withered and dry—the trash as it is called in colonial phraseology—being permanently attached to the stem. In the banana the axis continues to grow as long as the fruit hangs, cluster after cluster of flowers, with their bracts, opening and dropping away, a mass, like an enlarged *Nelumbium* bud, still unopened, remaining at the far extended end when the bunch is cut; while in the plantain the growth of the axis is arrested soon after the fruit sets, the abortive flowers opening, and remaining attached, from end to end of the stem.

"A single exception to the rule obtains in the case of the dwarf or Chinese banana (*Musa Cavendishii*), in other respects also specifically distinct, in which, as in plantains, the abortive flowers and their bracts are constantly persistent. Remembering this exception, and guarded from chance of mistake thereby, the untrained observer, seeing growing plants in fruit, may confidently determine which are plantains and which bananas, without attempting to assay the qualities of the fruit, upon which the great economic distinction above noticed is based. As mentioned before in the remarks on bananas, the texture of the plantain is such that at whatever stage it is used, whether green or ripe, it must be cooked to make it palatable. It is this quality in the plantain which makes the great economic difference between the two fruits."

M. sapientum and *M. paradisiaca* were described by Linnæus from cultivated and seedless specimens. Gaertner, however, pointed out that the distinction between seedless and seed-bearing plants was valueless. The identification of the original wild forms of all the numerous varieties of bananas and plantains, now under cultivation, is probably impossible. Within certain well-defined areas, such as those of Ceylon, Eastern India, Burma, Siam, Cochin China, Indian Archipelago, and Polynesia, where the wild forms and the cultivated varieties are growing almost side by side, the work of cultivation is, and has been, carried on to a considerable extent.

Allied, if not identical, with *M. sapientum*, the following seed-bearing forms have been described :—*M. seminifera*, Lour. Fl. Cochinch, 644 ; M. sapientum, *Roxb. Cprom. Pl.* t. 275 ; M. sapientum and Troglodytarum, *Gaertn. Fruct.* t. 11 ; M. balbisiana, *Colla, Monogr. Musa*, 56 (Rumph Amboin., t. 60, fig. 3). The fruit is small, oblong, full of seeds, not eatable, yellowish or greenish.

The Chittagong plant, figured by Roxburgh, grows in very soft soil, and has tall lanky stems. Kurz distinguishes two species, *M. sapientum*, with bracts often crimson inside, seeds turbinate-globular to polyhedrous, tubercled, not above $\frac{1}{6}$ inch diameter, and *M. sikkimensis*, with dull purple bracts and seeds depressed and irregularly angled, tubercled, 4–5 lines diameter. Of the latter, we have careful sketches made on the spot by Sir J. D. Hooker and it has been widely distributed as *Musa*, No. 5 of Hooker and Thomson's Indian plants. Pierre, in Sagot's monograph, describes in detail three forms from Cochin China.

Dr. King distinguishes four wild seminiferous forms in Sikkim as follows, viz. :—

1. *pruinosa* (" Reling " of the Lepchas). Stem, 10–25 feet high. Leaves very glaucous beneath, bracts deep violet-purple, glaucous outside, red inside, persistent, subtending the fruit ; fruit about 5 inches long by $1\frac{1}{2}$ inches diameter, permanently angled, seeds $\frac{1}{4}$ inch diameter, pulp very scanty. Altitude, 1,500–3,500 feet. Seeds of this are in the Kew Museum, from Mr. J. S. Gamble, F.L.S.

2. *dubia* (" Luxon " of the Lepchas). Stem lower, leaves not glaucous beneath, bracts deep lurid purple, not glaucous outside, purplish-red inside, lower bracts deciduous ; fruit 3–4 inches long, 1–$1\frac{1}{6}$ inch diameter, with prominent ribs, seeds $\frac{1}{4}$–$\frac{1}{3}$ inch diameter, pulp more copious. Altitude, 1,500–5,500 feet.

3. *Hookeri* (" Tiang-moo-foo-goon " of the Lepchas). Stem 10–14 feet high, tinged with red, leaves bright green on both sides, tinged with purple when young, bracts purple on both sides, glaucous outside, lower deciduous ; fruit 5–6 inches long, 2 inches diameter, prominently angled ; seeds 4–5 lines diameter, pulp scanty. Common, between 4,500 and 5,500 feet.

4. *Thomsoni* (" Kergel " of the Lepchas). Stem green, 12–15 feet high, leaves glaucous only when young, conspicuously cuspidated at the apex, bracts ovate outside, with vertical streaks of yellow

and purplish-brown, yellow inside; fruit 2½ inches long, ¾ inch diameter, faintly ribbed; seeds few, black, soft, ⅕ inch diameter, surrounded by copious sweet pulp. Does not rise above 1,500 feet.

Dr. King thinks the two latter forms are likely to be distinct specifically from *sapientum*. His *Hookeri* is probably *M. sikkimensis*, Kurz.

In the Kew Museum is a dried complete bunch of fruit marked *M. cliffortiana*, which, no doubt, represents the wild seminiferous state of *M. sapientum*. The fruits, densely crowded together in the spike are about 3 inches long, about ½ inch diameter, and completely filled with seed. This specimen was presented to Kew by the late D. Hanbury, F.R.S., in 1867.

Sub-genus Rhodochlamys.

Red-bracteated Musas.

24. **M. maculata**, *Jacq.* Stem slender, 7–8 feet high. Leaves green above glaucous beneath; petiole ½ foot long. Bracts yellowish-brown; flowers four in a cluster. Fruit oblong, 2–3 inches long, 1 inch diameter, narrowed gradually to the sessile base and apex, yellow, spotted with brown, eatable, aromatic; flesh, white. Known only as cultivated in Mauritius and Bourbon, where it is called *Figue mignonne*. Differs from the other species of this sub-genus by its eatable fruit.

*25. **M. sumatrana**, *Beccari.* Whole plant 7–8 feet high. Stem stender. Leaves glaucous with irregular blotches of claret-brown. Rachis hairy. Dried fruit cylindrical, curved, 2–3 inches long, ½ inch diam. *Distribution:*—Sumatra, province of Padang, alt. 1,100 feet, Beccari. Cultivated in India. Its affinity is with *M. rosacea*, Jacq. A sample of the fibre prepared from the stem of this species is in the Kew Museum from Mr. R. Derry, Malacca, 1889.

26. **M. violascens**, *Ridley.* Stem cylindrical slender, 8 to 10 feet high. Leaves glaucous beneath, 10 inches wide with a stout midrib. Spike erect or suberect, having bracts narrowly lanceolate, acute, white tinged with purple-violet or wholly violet, 9 inches long by 2 inches wide or wider. Female flowers 6 in a bract. Fruit green, 3 inches long, an inch thick, angular; seeds ¼ inch long, not angular. *Distribution:*—Malay Peninsula, Pahang, Selangor, and Sungei Ujong. This plant is distinguished by its erect or almost erect spadix, of which the bracts are remarkably long and narrow, acuminate and of a violet colour like that of a "brinjal." The flowers are few and arranged in single rows in each bract; sometimes the bracts are persistent after the flowers are fallen and hang down. The seeds are cylindrical and not angled and irregular as in the common banana and *M. malaccensis*. Although placed under the section *Rhodochlamys* the petal has the form of the section *Eumusa*.

*27. **M. rosacea**, *Jacq.* *Bot. Reg.* t. 706; *Lodd. Bot. Cab.* t. 616 M. ornata, *Roxb.*; M. speciosa, *Tenore*; M. Carolinæ, *Sterler.* Stoloni-

ferous. Stem cylindrical, 3–5 feet high, 3–4 inches diameter. Spike drooping or erect ; bracts pale blue or reddish-lilac. Fruit oblong, 2–3 inches long, but little pulp, scarcely edible. Seeds $\frac{1}{6}$ inch diameter, black, tubercled. *Distribution :*—Eastern Himalayas and hills of Concan. Flowered at Kew in 1881 and 1890. Introduced to Europe from Mauritius about 1805.

28. **M. salaccensis**, *Zolling.* Stem slender. Leaves thin, oblong, bracts pale lilac. Fruit oblong, full of seed ; latter dull brown, $\frac{1}{6}$ inch diameter. *Distribution :*—Mountains of Java and Sumatra. Described from specimens in the Calcutta herbarium, dried by Kurz, from the Buitenzorg Garden. Cosely allied to *M. rosacea.*

29. **M. velutina**, *Wendl.* and *Drude*, in *Regel. Gartenfl.*, 1875, 65, t. 823 ; M. dasycarpa, *Kurz.* Habit of *M. sanguinea.* Bracts bright red, pubescent on the outside. Calyx pale yellow. Fruit velvety, bright red. *Distribution :*—Throughout the forests of Assam (Mann). Introduced to cultivation in 1875. Differs from *sanguinea* and *aurantiaca* by its red pubescent fruit.

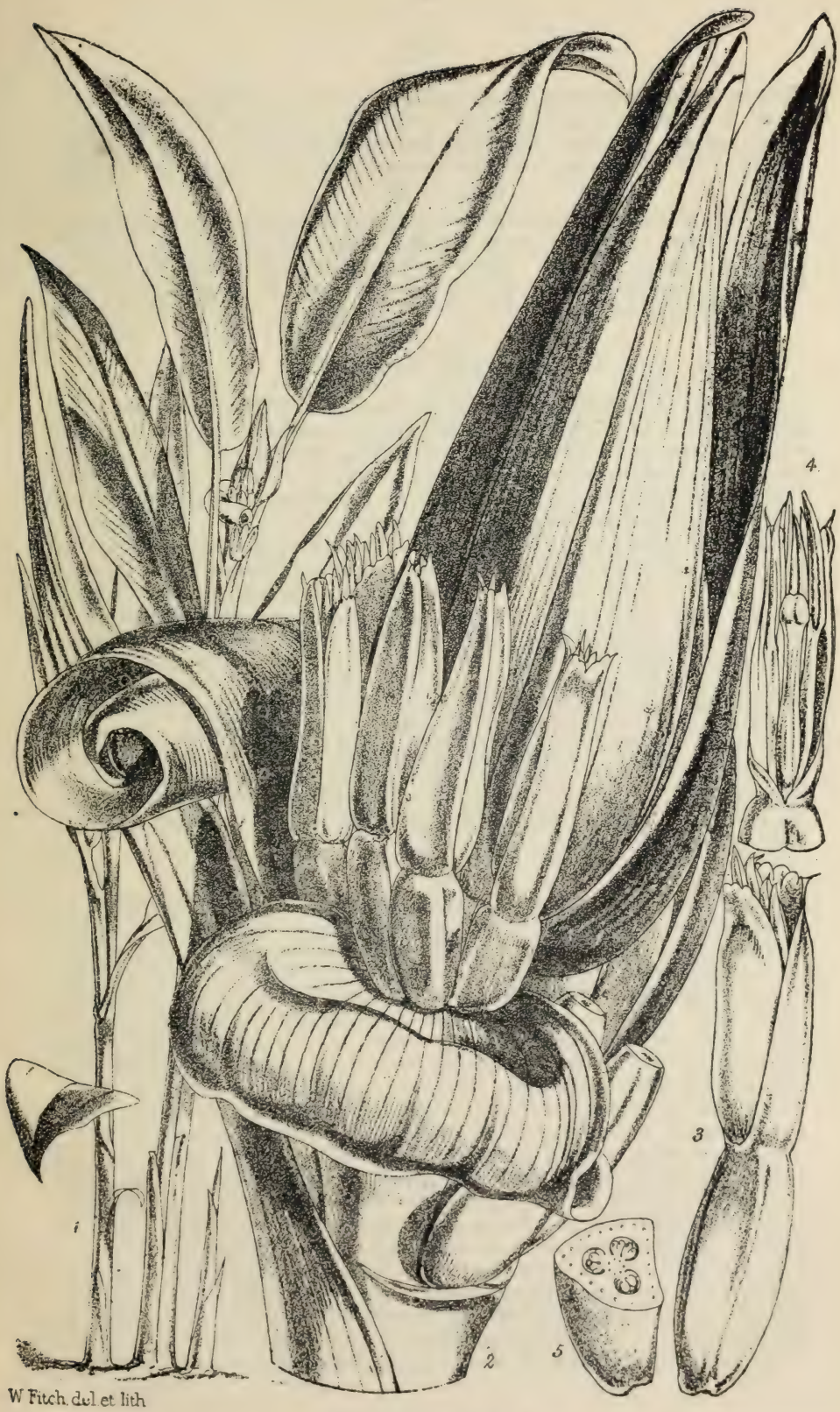
*30. **M. coccinea**, *Andr. Bot. Rep.* t. 47 ; *Bot. Mag.* t. 1559 ; North Gallery, No. 696. Stem stoloniferous, slender, finally 4–5 feet high. Rachis erect. Spike dense, erect ; bracts bright red or tipped with yellow. Fruit oblong-trigonous, not edible. Seeds very small. *Distribution :*—Southern China and Cochin China. In the latter country it is called *Chuoi tau.* Introduced into cultivation in 1791 and now widely spread. Specimens of fibre prepared from this species are in the Kew Museum from Jamaica, prepared by Nathaniel Wilson, and also from Mauritius.

31. **M. rosea**, *Hort. Calcutt.* Stem stoloniferous. Habit of *M. coccinea* but leaves shorter and broader. Spike short, erect ; rachis pubescent not flexuose ; bracts pale red. Fruit and seeds not seen. Described from two specimens in the Calcutta herbarium that flowered in the Botanic Garden there in June 1882.

*32. **M. sanguinea**, *Hook. f.* in *Bot. Mag.* t. 5975. Stem very slender, 4–5 feet high. Stoloniferous. Bracts bright red. Calyx bright yellow. Fruit oblong-trigonous, 2 inches long, rather pulpy, pale yellow-green variegated with red, glabrous. Seeds angled by pressure, small, black, tubercled. *Distribution :*—Upper Assam (District Lukhimpore) Mahuni forest, (Mann.). Introduced into cultivation in 1872. *M. assamica*, Hort. Bull, is an allied plant, at present imperfectly known ; it may prove to be distinct. Specimens of the fruits with seeds of *M. sanguinea*, ripened in the Palm House at Kew in 1872, are in the Museum.

*33. **M. rubra**, *Wall.* Habit of *M. coccinea.* Bracts bright red. Fruit in 3–4 clusters of 3–4 each, cylindrical. Seeds smooth, dull brown, $\frac{1}{6}$ inch diameter. *Distribution :*—Rangoon and Yomah, Pegu. Differs from *M. coccinea* by its short petal. [*Bot. Mag.* t. 7451.]

*34. **M. Mannii**, *Wendl. ; Bot. Mag.* t. 7311. Stoloniferous. Stem cylindrical, slender, tinged with black, 2 feet high and with a girth of $3\frac{1}{2}$ inches at the base. Rachis with spike erect ; bracts of female



Musa sanguinea, Hook. f.
(*Botanical Magazine*, t. 5975.)

1. Reduced figure of entire plant. **2.** Head of flower *of the natural size*. **3.** Hermaphrodite flower. **4.** Perianth laid open. **5.** Transverse section of ovary.

flowers deciduous ; male bracts crowded, oblong, pale crimson. Fruit small 3–4 inches long, fusiform with a very broad truncate apex. *Distribution :*—Assam. Described from a plant that flowered at Kew, March 1893. [Seedlings of this crossed with *M. rosacea*, are now at Kew.]

*35. **M. aurantiaca**, *Mann. Herb.* Habit of *M. sanguinea*, but forming large clumps of rather lower stems. Bracts bright orange yellow, glabrous. Calyx yellow. Fruit green, glabrous. *Distribution :*—Forests of Upper Assam. Differs mainly from *M. sanguinea* by its orange-coloured bracts.

Cultivated Varieties.

Some of the cultivated varieties of bananas and plantains known in different parts of the world have already been mentioned in connection with the species described in the preceding section. There are, however, numerous varieties whose origin cannot, in every instance, be clearly traced. There is a good deal of confusion existing also as to what are varieties and what are mere forms. In fact, the information available in regard to cultivated bananas is in need of being thoroughly sifted and arranged. In the present state of our knowledge it is only possible to enumerate the various sorts under their vernacular names, and to add a few notes giving their special or most prominent characters. This may more conveniently be done under the principal geographical regions in which they are found. The principal authorities cited are the following :—Rumph, *Herb. Amboinense*, vol. v., pp. 125–137 ; Blanco, *Flor. Filip.*, pp. 239–246 ; Firminger's *Manual of Gardening for India*, ed. 3, pp. 179–181 ; Bojer's *Hortus Mauritianus*, pp. 331–332 ; Sagot in *Journ. Soc. Hort.* France (1887), pp. 238–285 ; Kurz in *Journ. Agri.-Hort. Soc.* India, n.s., vol. v., pp. 112–163 ; Diaz, *El Agricultor Venezolano* (1877), pp. 37–43 ; Harrison and Jenman, *Report on Agricultural Work*, British Guiana, 1890, pp. 56–62.

India.

"In such a large empire as India one might expect," says Kurz, "to find the greatest variety of bananas, but such is not the case." The Philippine Islands and the Indian Archipelago are richest, and, on the authority of Moon, Ceylon comes next. The varieties appear to decrease rapidly as we travel northward from the equator. Roxburgh states that he obtained in India only three varieties of the "plantain" and about 30 varieties of the "banana." Rheede (1678–1703) appears to be the first authority that wrote intelligently on the bananas and plantains of India. He gives them the Malabar name of *balá*. In the first volume of his *Hortus Malabaricus*, pp. 17–20, he enumerates and illustrates several varieties : *neudera balá* with oblong red fruits ; *caduli-balá* with a thin skin and pulp of pleasant taste ; *puambalá* with terete fruits with a good taste ; *mannem-balá* with four-cornered fruits and a thick skin ; *canim-balá* producing no other flowers but fertile ones, has the fruits small and yellow when ripe ; *calembalá* has the fruits full of black seeds and a rather thick skin.

In **Madras** a sort known as *guindy* is considered the best as a dessert fruit. It is round, small-sized, with a very thin rind, luscious, sweet, and of a most delicate flavour. "A good bunch may contain over a thousand fruits" (*Dict. Econ. Products of India*, vol. v., p. 293). This kind is used entirely as a table fruit, being considered too valuable

for cooking purposes. The *rustali* is, however, the sort generally sold as table plantains, though not of so good a quality as the former. A large plantain known in Tamil as *monthen* is one of the commonest cooking fruits of the Presidency. The *poo-valay* or flower plantain of Madras is described by Kurz as "curious and rare."

In **Bengal** the *table plantain* is the best. This is grown entirely for the consumption of Europeans and well-to-do natives. The *champa* is the next best, and, like the preceding, is of finest quality during the rains. The term *kauch* [katch] *kolla* is employed generically to embrace all field-cultivated plantains. These are hardly ever allowed to ripen, and are mostly used when unripe as a vegetable.

The *dacca* plantain (described by Horaninow as *M. dacca*), although mentioned as one of the common Indian forms is dismissed by Kurz with the remark that, "although much cultivated in European hot-houses, it is little known out of them." The stem is pruinose; leaves paler-green than in *M. sapientum*, glaucous beneath; border of petiole red. Fruit 4 inches long by half as broad, remaining tightly on the branch; its tip and stalk bright green; skin very thick.

If identical with the *dhakkai* mentioned by Liotard, and said to have a long fruit, with light pink soft flesh, it is found in abundance in India, but only in the east of Bengal. It may also be the *daccâe* mentioned below by Firminger.

In the neighbourhood of Calcutta, Firminger (*Gardening for India*, pp. 179–181) mentions the principal varieties of plantains cultivated there as follows:—

Champa. Decidedly the finest of all the plantains, rivalling in lusciousness and delicacy the most delicious pear. The plant has a tinge of red on the stem, and the central rib of the leaf, both on the upper and lower side, is also red. The fruit is about 6 inches long, of a pale straw colour, and not fit to eat until it can be removed easily from the bunch.

Cheenee champa. Similar to above, but the fruit much smaller, not much larger than a man's thumb. It is borne in large, densely compact bunches.

Martaban. A delicious fruit resembling the *champa*, and by some considered equal to it. The plant has no red midrib, but the rim near the base has a slight border of reddish brown.

Daccâe or *daccâe-martaban.* Has a flavour surprisingly rich and luscious. The plant is recognised by "the large quantity of lime-like powder coating the stem and under-side of the leaves. The fruit is 4 inches long, with a very thick rind." [A specimen of the fresh fruit of *M. dakka* is in the Kew Museum from Mr. H. H. Calvert, grown at Alexandria, Egypt. It is very angular, and in section the placentas are strongly marked.]

Kuntéla. An inferior fruit, though the one cultivated most extensively of all, and sold in great quantities in the bazaars. "The cause of the very great demand there exists for this particular kind among the natives is on account of its being employed in offerings to Seeva, it being the only sort, too, they think right to use for that purpose." The plant has the leaves and footstalks of a pure rich green. It grows to a great height.

Kutch kela. Fruit of large size, used only in its unripe state for curries. "When boiled it has somewhat the flavour of the parsnip, and is a nice vegetable with roast meat." [The model of a large fruit in the Kew Museum, labelled *Musa kela*, probably represents this variety.]

Mâhl-bhôg or *mohun-bhôg*. Highly esteemed by some, but probably not much superior to the *kuntéla*.

Râm kela. In good condition a remarkably fine fruit, much resembling in flavour and buttery consistency the *daccâe*. The stem and footstalks and midribs are of a dark red colour, also the flowers. The fruit is about 7 inches long and rather thin. This Firminger names *Musa rubra*, now reduced as a variety of *M. sapientum*. On the other hand *M. rubra* of Wallich is a seed-bearing species allied to *M. coccinea*.

Dwarf or *Chinese* Plantain [*M. Cavendishii*]. In Calcutta this is exceedingly difficult to obtain in perfection, as it is uneatable till quite ripe, and on its becoming ripe commences almost immediately to decay.

Arracan plantain. Sent from Arracan by Captain Ripley, who observed, "If well manured the fruit of this tree is one of the best plantains there is; the old trees yield particularly fine fruit." Besides the above, Captain Ripley sent to Calcutta eighteen other named sorts of plantains from Arracan, of eleven of which he wrote in high commendation. The *moungbya* has the skin "of a dead white and very thick."

Captain Ripley was acquainted with 19 kinds, described by him from Arracan in the *Proceedings of the Agri.-Hort. Soc. India*, x., pp. 50, 51.

The *hnet-pyau-meng* (royal plantain) has fruits up to 15 inches in length and as large round as the fist. It is generally eaten roasted whole in the skin. *Rakoing-hnet-pyau-bhee* or Arracan plantain (*Musa arakanensis*, Ripley) mentioned above is also valuable for its fibre. Nothing further is known of this plant. Specimens of it are desirable for herbarium purposes.

In the **Punjab** the *kela*, which may be a true plantain (*M. paradisiaca*) is largely grown towards the east of the plains of this province. There are fewer varieties and the quality of the fruit is poorer in the Punjab than to the east and south. At Mussooree, in the North Western Provinces, there are only three kinds of bananas cultivated. These are *rai kela*, *bara kela*, and *chota kela*. In Oudh the only plantain that flourishes is a large-fruited one called *desee kela*. A small sweet fruit called *jmritban*, probably a local corruption of Martaban, and the *cheenee champa* or red Bombay, are also grown, but neither thrives well.

Ceylon.

Moon, in his catalogue of **Ceylon** plants, gives only the Singhalese names and their English equivalents. His list of bananas (pp. 71–72) comprises as many as 47 kinds, thus rendering Ceylon richest in varieties, the Indian Archipelago alone excepted.

Of *Musa paradisiaca* ("anawálu-kesel" of the Singhalese) Moon enumerates the following:—Wild, growing on the mountains: *anawálu-kesel aetamburu* (seed), and *anawálu-kesel-gal* (rock). Cultivated: are names with the following English equivalents: sour, sooty, parrot, black, buffalo, champac, lion, and monkey.

Of *Musa sapientum* ("kesel" of the Singhalese) there are wild, growing on the mountains: *kesel ael* (hill), *kesel aeta* (seed), *kesel titta-kadali* (bitter), *kesel wal-suwanda* (wild-fragrant), and *kesel wal-wanduru* (wild monkeys). Of the cultivated sorts belonging to this series Moon gives 25 under their Singhalese names and their equivalents. Amongst the latter are such names as water (*kesel diya*), black (*kesel kalu*), and others known as eared, fragrant, cornered, scented, golden, cracker, pingo, clustered, bitter, fool's, powdered, &c.

Musa troglodytarum of Moon ("nawari kesel" of the Singhalese) is said to be wild in the mountains of Kandy, although not mentioned by subsequent writers. Of this there are said to be three cultivated sorts, *nawari-kesel sudu* (white), *nawari-kesel kalu* (black), and *nawari-kesel tis* (thirty). The wild plant is *nawari-kesel aeta*.

Thwaites mentions only one wild species in Ceylon, his "wal-kaikel gas" (*Musa sapientum*), and he adds this is the species from which have originated the numerous varieties of sweet plantains in the island. Kurz remarks: "There seems to be something wrong in this statement, considering that Moon has eight wild kinds, of which one (his *M. troglodytarum*) should have an erect spadix."

Sawers (*Mem. Wern. Soc.*, iv., 403), refers to the wild species of plantain found in the mountains of Ceylon as follows:—"It was on the sides of these rugged hills that we first saw the plantain-tree in a state of nature. When uncultivated the fruit of this plant is comparatively small. It contains a great many seeds and has but little pulpy matter."

Indian Archipelago.

The **Philippines** and the **Indian Archipelago** are regarded as the richest regions in bananas. Blanco's researches were chiefly confined to those of the Philippine islands. He divides them into two classes, the first containing thick-skinned bananas and the second thin-skinned bananas. He mentions that there were 57 varieties known in the islands, and he enumerates and names 18 of them. The most esteemed sort is *saba-bisco*, with a fruit 3 inches long by 1 thick, 3–5 angular. The *lacatan* has the fruits crowned with the persistent corolla. One of the most esteemed is a large one with a sweet pulp, called the *bungulan*. One variety, called by Blanco *Musa paradisiaca ulnaris*, is thus described:—"Those that have seen and eaten the fruit say it is as thick as the human thigh and a yard long and bears seeds. If cooked it resembles in taste that of the *tandok*. The Negritoes say the raceme produces but one fruit." Blanco is careful to add that he himself does not believe in the existence of such a fruit.

In Lucon, Née observed 27 varieties of bananas, but he has not given their names nor any remarks upon them.

Rumph appears to have known more about bananas than any one. He has given an accurate description of the plants, and he divided them into three groups, as follows:—(1) The cultivated or domesticated bananas; (2) the Alphurian bananas, with leaves on the rachis; and (3) the wild bananas. His detailed descriptions of the varieties are very carefully drawn up. Some of the kinds enumerated by him are as follows:—

Pisang tando (horn-like). No doubt similar to the one called tanduk or tandok at the present time. If the cluster is reduced to a single fruit, the latter becomes exceptionally large. The whole bunch or spadix has usually only two or three clusters. *Pisang gabba-gabba* is smaller than the preceding, becoming white in ripening. It has the driest pith of all, which is like the spongy pith of the Sago palm, called "gabba-gabba."

Pisang djernang (needle banana). The fruit is short, nearly trigonous and terminating in a long snout, which is crowned with a thread-like appendage (the marcescent style), hence the name. The skin adheres to the reddish pulp, which glitters like sugar when transversely broken. It is said "to bear racemes 7 feet long with 17 clusters."

Pisang culit tabal (golden banana). The fruit is five-cornered, and has the thickest skin of all the bananas.

Pisang medji. The dessert-banana (*M. mensaria* of Rumph), is "the best of all bananas." The fruit is about 4–6 inches long; it ripens quickly, is yellowish, and the skin is easily removed. The pulp is soft, sweet, and deliciously scented, as if with rose-water. Always eaten raw.

Pisang raja (to which Rumph gave the name of *M. regia*), is similar to the preceding in shape and quality. It is, however, much smaller, hardly the length of a finger and an inch thick, smooth with a thinner skin, and sweeter and more delicious, on which account it is the most prized as a dessert fruit in Batavia. It is not cultivated at Amboyna, where it is replaced by the preceding kind. Probably nearly allied to the *gingeli* of Bourbon.

Pisang swangi is short and thick. The pulp deep yellow or red. Cannot be eaten raw, but is good for roasting.

Pisang abu, *pisang soldado*, and *pisang alphuru* are small, short and thick fruited sorts, rather flat and compressed. Very good for roasting and cooking.

Pisang bombor has the shortest fruits, the size of a hen's egg. Good for eating raw when fully ripe; otherwise it is sourish and acid, and must be boiled.

Pisang cananya ketjil. This has the shortest stem and the smallest leaves, and is only about as high as a man. The fruits are round, the skin very thin, fragile, and can hardly be removed. The fruits grow so low that "they can be taken off with the mouth," and they are often 200 on a bunch. The plant is only sparingly soboliferous.

Pisang tonkat langit has an upright-fruited spadix (*Musa troglodytarum*, Linn.). The fruits are small, plump, more thickened towards the upper end, of a red colour and black striped. The pulp is golden yellow. The few seeds are imbedded lengthwise, brown and flat. The "djantong," or sterile flower cone, is much larger than in any other bananas, sometimes a foot long, green and smooth.

Pisang alphuru. The peduncle is peculiar in bearing leaves, "two of which are at the base and similar to those of the stem, but shorter and rounder. Then follow other leaves which are small and narrow, and from each of them rises a thick green stalk on which grow a few fruits, of which, however, only a few come to perfection." As in other respects this resembles the common banana, it may be an abnormal form of it.

Pisang utan (Musa sylvestris of Colla), is the larger kind of wild banana. One form (the Mindanao of Rumph) is *Musa textilis*, Née, yielding Manila hemp. The other (Ambon variety of Rumph) is *M. textilis*, var. *amboinensis.* These have been already described in the previous section.

From other sources we gather that bananas in Java are called *pisang maas*, or golden pisang, on account of the colour of the peel. There are so many varieties that they can scarcely be counted. The *pisang sariboe* is the smallest kind of pisang, as the *pisang tandok* is the largest. The *pisang maas* is quinquangular, and its taste resembles that of figs. Among the other sorts the most remarkable are *pisang medji* (dessert pisang), the *pisang raja* (royal), which is thought to be the most wholesome; the *pisang mera*, or red pisang, whose leaves from their very base are of a brownish-red as well as their bunches of fruit, and the *pisang batoe* or *bidgi* (stone or seed pisang), which is not much eaten. There is yet another kind of Musa, the wild pisang, "whose

leaves on the outside are covered with a species of white wax" (*van Nooten's Java*, 1863).

Rigg, in his dictionary of the Sunda language, gives a list of about 40 names of plantains in **Western Java**. The word *djauw* is the Sunda for pisang or plantain. The most singular is the *lubang*, or eel plantain, described by Kurz as "a very rare variety; the fruit is said to ripen in the stem before it is protruded hence, likened to an eel in a hole." In the *sambatu* the fruits grow together, as if glued into one mass. Marsden, in his history of **Sumatra**, mentions that there are 20 varieties cultivated in that island, of which *pisang raja*, *pisang dinger* and *pisang kalé* are the best.

Of the bananas of **Siam** little is recorded. The fruit is there called *tun-bloi* or *kloh-eh*. Mason collected the names of 25 varieties in **Burma**.

Specimens of fresh fruits of *pisang maas*, of *pisang susu*, and of *pisang tandok*, preserved in spirit, are in the Kew Museum, from Mr. H. N. Ridley, F.L.S., Singapore, 1894.

Burbidge, in the *Gardens of the Sun*, pp. 321–2, reviews the different varieties of plantains and bananas that came under his observation in the East, as follows :—

"Last on my list, but by no means least amongst the tropical fruits of Eastern gardens, comes the *pisang* or banana, which here, as elsewhere wherever it is cultivated, is represented by many varieties, which differ in size of fruit, flavour, and other particulars. One of the most common varieties met with in the bazaars is *pisang maas*, or golden banana, the individual fruits of which are small, but of a bright golden colour and of excellent flavour. One of the most esteemed of all is *pisang raja*, or king of bananas, a larger fruit, also of a deep golden colour, the flavour being very luscious. *Pisang hijau*, the green banana, is slender and angular, but the straw-coloured pulp is of a most exquisite flavour, and it is quite a favourite in Singapore, where the *raja* variety is comparatively scarce. *Pisang kling* is a pale yellow kind, bearing large smooth fruits, and for eating with cheese this is one of the best, being less sweet than those just named. A large horned variety of banana (generally used in a cooked state) is common in Borneo, called of the natives *pisang tandok*, the individual fruits being a foot long and two inches in diameter. The outer skin is green, changing to yellow when fully ripe, and this fruit is liked by those who do not relish the sweeter kinds."

Polynesia.

There are numerous wild and seed-bearing bananas in the islands of **Polynesia** probably undescribed. Specimens of these, but not sufficient for determination, have been received at Kew from the Solomon Islands, from Mr. H. B. Guppy, and from Timor Laut from Mr. H. O. Forbes.

Ellis mentions that in the Society Islands nearly 20 kinds of plantains (probably forms of *M. Fehi*), very large and serviceable, grow wild in the mountains. "These are rich and agreeable when baked, but most unpalatable when raw. They have a red skin and a bright yellow pulp. Their native name is *fei*." The best banana in Tahiti is called *huamene*.

Tropical Africa.

The different varieties of bananas and plantains cultivated in tropical **Africa** have not been investigated. The native names quoted appear to stand simply for banana or plantain, and, except in one or two instances,

do not apply to the varieties. At Angola, Welwitsch met with a very ornamental variety of *M. sapientum*, which he named *M. sanguinea*. In this the "leaves and fruit are strongly tinged with blood-red." Another ornamental plant, also belonging to *M. sapientum*, and from West Africa, is *M. vittata* figured in *Bot. Mag.* t. 5402. This has the leaves and long fruits copiously striped with white. The bracts are bright red inside." It was imported into this country in the first instance from the Portuguese island of São Thomé, in the Gulf of Guinea.

Burton (*Central Africa*, p. 58) states that in the hilly countries around **Uganda** there are about a dozen varieties. . . . The best fruit is that grown by the Arabs at Unyanyembe. . . . Upon the Tanganyika Lake there is a variety called *mikous t'hembu*, or elephant's-hands, which is considered larger than the Indian horse-plantain. The skin is of a brickdust-red, in places inclining to rusty-brown ; the pulp is dull yellow with black seeds, and the flavour is harsh, strong, and drug-like.

Stanley (*Darkest Africa*, I. p. 252) refers to specimens of plantains found beyond Yambuya that were "22 inches long, 2½ inches in diameter, and nearly 8 inches round, large enough to furnish even Saat Tato, the hunter, with his long-desired full meal." Again, at Bokokoro, "some plantains measured here were 17½ inches in length, and as thick as the forearm."

Mauritius and Madagascar.

Bojer (*Hort. Maur.*, p. 331) mentions that in 1837 bananas and plantains were widely cultivated in Mauritius, Madagascar, Mozambique, and the Comoro Islands.

He enumerates 17 species and varieties cultivated at Mauritius, and gives both the Creole and Malagasy names as far as he knew them.

There are two species specially mentioned producing seeds, and these he calls *bananier á graines:* (1) *Musa sapientum*, L. of the East Indies, grown near dwellings in various quarters of the island. It thrives also without cultivation on the sites of abandoned gardens and other localities in the hilly district of Flacq and the mountains of la Nouvelle Découverte ; and (2) *Musa glauca*, Roxb., grown under cultivation in many parts of the island, but said to flower very rarely. It is probable that the first of these is the true banana with seeds (*bananier á graines*), and therefore to be regarded as representing the wild form of *M. sapientum*. In a note just received from Mr. John Horne, F.L.S., late Director of Gardens and Forests at Mauritius, he writes :—"I know the *bananier á graines*, and I have raised it from seed. Every clump of this (wild in the mountains) is known to the Coolies and Creoles who readily eat the fruit, which must therefore be watched to obtain it in a perfectly ripe condition. The stems of this banana abound in fibre of excellent quality."

The fruits of *Musa paradisiaca* (of Bojer) are called Akundru lika-lika by the natives of Madagascar, while the French call them *bananes malgaches*. Bojer enumerates the following kinds :—

Akundru bara-baha of the Malgachees (*bananes malgaches vertes*) : fruits resembling those of akundru lika-lika, but they are shorter and more curved. Skin green, the pulp white, soft, and sweet.

Akundru minetine ; fruit straight, cylindrical, green turning brown ; pulp whitish, very sweet. A variety of this has the fruits very like

those of the preceding, but they are only slightly curved, angular, the pulp whitish, of an exquisite taste and odour.

Akundru-makaï-fahaï (*bananes jaunes* or *bananes à régime court*) : fruit medium size, straight, cylindrical, the skin and the pulp yellow, the latter firm and sweet.

Akundru-bara-hassok (*bananes malartic* or *bananes rouges*) : fruit straight, cylindrical, sometimes slightly cornered, the skin thin and of a red colour when ripe, the pulp yellow-reddish, of a very sweet taste and odour.

Bananes malartic vertes of the French. Fruits exactly like those of the preceding, but they remain green also when fully ripe.

Bananes gigantesques de Chine. Fruit very large, oblong, slightly curved and angular, the skin yellow and very thick, the pulp yellow-reddish, somewhat firm, of a little acid taste.

Akundru-lambu of the Malgachees (*bananes de Chine* or *bananier nain*) : stem very short and very stout, the leaves oval, larger and firmer than those of the other kinds. The raceme often attains such an enormous size that one man cannot carry it. Fruits yellow or green, slightly curved and cornered ; pulp yellowish, of an exquisite taste and odour.

Akundru-zaza (child's banana) of the Malgachees (*bananes gingeli* of the French) : fruit very small, straight, cylindrical, the skin thin, yellow ; pulp yellow, very sweet and of an agreeable odour. This kind is most esteemed.

Bananas d' Otahiti: fruit somewhat larger than that of the preceding, somewhat curved and angular, the skin yellow or green and very thick ; pulp yellowish and of an agreeable taste.

Akundru-foutsi of the Malgachees (*bananes blanches*) : fruits middling sized, straight, cylindrical, the skin and pulp white, the latter of a mediocre taste.

The banana mentioned above as the Chinese or dwarf banana (*M. Cavendishii*) is a distinct species. This was introduced to England by way of Mauritius in 1827, and first grown in this country by Mr. Barclay at Buryhill. It was afterwards distributed from England, as already mentioned, to the Islands of Polynesia.

There is a sample of fibre in the Kew Museum from the Botanic Garden, Mauritius, sent by Mr. John Horne, F.L.S., 1870, marked *M. violacea.* This is probably a garden variety of *M. acuminata* (*see* p. 245), with the stem, fruit, and often the leaves beneath, more or less tinged with violet or purple.

Although it is pretty well established that the **New World** received its plantains and bananas originally from the Old World it is evident that there are now numerous varieties established there. Some of these can be recognised as similar, if not identical, with well-known varieties in the East Indies. On the other hand, some have doubtless developed under new conditions of soil and climate and under the incidental variation induced by change of environment and results of cultivation. The local names are very loosely applied. The Spanish names for the most part are limited to three kinds. The true *platano arton* is the plantain used as vegetable, while the *camburi* and *dominico* are varieties of the banana with a sweet fruit, and eaten raw. The dwarf or Chinese banana (*M. Cavendishii*) has become very common of late years. This was doubtless introduced direct from Mauritius (where we have a first record of it after Cochin China) or by way of England. With the exception of the latter it is probable that the edible-fruited banana and plantains of the New World are all forms of *M. sapientum.* The

herbarium material available at Kew does not contradict this assumption, but it must be admitted that no one has given particular attention to the subject or collected adequate material upon which to base an authoritative opinion.

Martinet enumerates the three bananas cultivated in **Peru** in the neighbourhood of Lima (*Jard. Bot. Lima*, 1873, p. 51), as follows :— *platano guineo*, *platano lugo*, and *platano de la isla*.

Humboldt states that a Peruvian banana called *meija* is known in the market of Lima as *platano de Taiti*, being supposed to be introduced from Tahiti.

British Guiana.

Messrs. Harrison and Jenman, in their Report already cited, state :— There are two varieties of plantains chiefly cultivated in **British Guiana**, namely, the White plantain (called also the Cow plantain, Common plantain, or Maiden plantain), and the Black plantain. The others are the Giant or Horse plantain and the *barooma*. Both of the latter are very large fruited kinds. The *barooma* is not much grown.

The White plantain with a green stem and green leaf-stalks is the kind chiefly grown. It is prolific and very valuable, as the fruit is of the best quality and adapted for all purposes for which plantains are used. The Black plantain is exactly similar to the White plantain in character, but the leaf-stalks and sheaths of the leaves (*i.e.*, the stem) are purple or blackish.

For the banana the local name is *bacooba*, a term of Indian origin (evidently borrowed from its resemblance to the *Heliconia*, a native plant common in tropical America), but now generally adopted by the Creoles. Bananas are not largely grown in British Guiana, the quantity produced is, however, fully sufficient to meet local demands. There is no separate cultivation as for plantains, and they appear to hold quite a secondary place in the domestic regime of the colony. Plantains are regarded as an essential article of food, while the bananas are an added luxury, and they can be dispensed with or not according to the circumstances of the moment.

The most abundant banana in the market at Georgetown, as a rule, is the dwarf or Chinese banana, and next to that the large and small fig bananas. The latter are favourites with the well-to-do people. The varieties grown in the colony are as follows :—

Small Fig or *Lady's Finger :* fruit densely packed, clear straw colour when ripe, 3 to 4 inches long, pulp melting, flavour good.

Large Fig or *Cokerite :* fruit curved as a rule, 4 to 5 inches long ; good bunches contain 300 to 400 fruits ; strongly recommended for export purposes.

Martinique or *Jamaica :* fruit greenish yellow, 8 to 10 inches long, of sweet flavour with a slightly astringent after-taste.

Surinam or *sour :* fruit slightly curved, 6 to 8 inches long, clear straw colour when ripe, texture of pulp rather woolly when broken, the centre harder, of a distinct sub-acid taste.

Giant green or *Canaan :* fruit stout, densely arranged, 6 to 7 inches long, colour a beautiful yellow when ripe.

Giant red : fruit stout, dull red, 5 to 7 inches long, flavour good. Both this and the last are too stout for ordinary dessert purposes.

Arrababa or *apple :* fruit of soft texture and slightly sub-acid, 7 to 8 inches long, skin very thick, pale yellow when ripe. "A peculiar

kind in all characters of the fruit; the shape, thickness of the skin, texture, and taste are all unusual. It is not of much use for eating raw like other bananas, but cooked it is the best of all."

Chinese or *dwarf:* fruit curved, 7 to 9 inches long, greenish yellow; produces the heaviest bunches of all, often exceeding 80 pounds and containing 200 fruits. "Sometimes the bunches appear nearly as long as the stem of the plant bearing them."

Venezuela.

An account of the principal varieties of banana recognised in **Venezuela** is given by Diaz in *El Agricultor Venezolano* (1877), pp. 37–43.

El platano or *platano arton* is the common plantain widely distributed throughout tropical America.

Platano dominico, the royal or small-fruited plantain, is very similar to the common plantain in appearance and habit; the fruit, however, is smaller and the plant somewhat hardier, that is, it bears better the cold of the mountains.

Platano topocho or the topocho plantain. Diaz regards this, to which he has given the name of *Musa mixta*, as a hybrid between the common plantain and the red banana. It approaches the former in the character and flavour of the fruit; the latter in its robustness, habit, and power of resistance to dry weather. On account of the latter quality the *topocho* and red banana are preferred as shade plants on coffee lands on the hills. The fruit of the *topocho* when ripe is readily eaten by man and animals. "It is a special favourite of hens, ducks, turkeys, and all the feathered family."

Cambur morado, or the red banana, differs from the preceding in the colour of the stem and fruit. The fruit of this red banana is specially suitable for preserving by being dried in the sun.

Cambur criollo or the Creole banana. The plant is smaller than either of the above, the stem is stained with blotches and black streaks, the fruit is small and very palatable to eat with dessert. In a green state it is most suitable as an addition to the Spanish *olla* or stew.

Cambur manzano or the apple banana. The stem and leaves are tinged with red; the fruit is as small as the Creole banana. It has a very delicate flavour and it is the most highly esteemed of any.

Cambur pigmeo or dwarf banana. This hardly attains a height of 5 feet (probably the Chinese banana, *M. Cavendishii*). The bunch of fruits is so large that it sometimes touches the ground. The fruit is slightly larger than the Creole banana, but with a similar flavour.

Fresh fruits preserved in spirit of two kinds of plantains and bananas from Venezuela are in the Kew Museum. These were originally sent to the International Exhibition of 1865, and presented by the Republic of Venezuela. The first is marked *platano dominico*, "bannanier royal" or Royal plantain; the fruit is about 8 to 10 inches long, 2 inches diameter, rather prominently ribbed, almost quadrangular, much curved, with the point produced but blunt. The other is named *camburi guineo*, "figues bananes de Guinie" or fig banana. The fruit is 6 to eight inches long, 1½ inches diameter, slightly angular and almost terete, moderately curved, rounded at the top and crowned by the

withered parts of the flowers. This appears to approach very closely the Martinique or Jamaica banana in size and colour.

West Indies.

The varieties cultivated in the West Indies for export purposes are thus described by Dr. Nicholls, F.L.S., in *Tropical Agriculture*, p. 160.

"There are a great number of varieties of the banana, as might be expected when it is remembered that the plant is cultivated throughout the whole tropical world—on different soils, in different climates, and under different conditions. The kinds most liked, however, in the American markets are the Martinique variety, with its large yellow fruits, and the Cuban variety which has shorter and thicker fruits with a dull-red skin. The Martinique kind is now the principal one exported, and it is known throughout the United States as the 'Jamaica banana.' In Dominica it is called 'figue la rose,' and in Trinidad 'Gros Michel' banana."

Of plantains, as distinct from bananas, there appear to be in the West Indies two principal sorts, the "horse plantain" and the "maiden plantain." The distinction between the two is given below.

Acosta, quoted by De Candolle (*Cult. Plants*, p. 309), says that in Hispaniola or **San Domingo** "there is a small white species of banana, very delicate, which is called in Espagnolle 'dominico.'"

The cooking plantains cultivated in **Jamaica** are described by Lunan, p. 74, as follows:—

"There is a variety known by the name of *maiden* plantain, the common kind being called *horse* plantain, which differs from it in being of a smaller and more delicate growth, and having red streaks on the stem; as also in smaller but much more clustered and numerous fruit; the maiden plantain bunch growing more like that of the banana, containing often from 80 to 100 plantains, and weighing often 80 pounds, whereas the bunch of the common plantain seldom contains more than 20. These trees bear fruit fit for use in from 9 to 12 months after the suckers are planted, according to soil and seasons; the horse plantain takes three months to fill from the time it first shoots, and the maiden plantain four; the latter is the most delicate food."

Dr. de Verteuil describes the plantains of **Trinidad** briefly thus:—

"Like all cultivated plants, the plantain has many varieties: there exist, however, three distinct sorts. The *horn* plantain, from the resemblance the fruit bears to the horn of a young bull; the *French* plantain and the *Dominica* plantain. The *horn* plantain is more extensively cultivated than the other sorts, being hardier and not requiring frequent replanting; but though the fruit is much larger, whence it also obtains the *sobriquet* of *horse* plantain, its bunch is not so well supplied, having ordinarily but 25, and often fewer, plantains or fingers to the bunch; as an edible it is also much coarser than the other species. *French* or *maid* plantain: the body of this plant is of a dark violet colour, as also the nerves of the leaves; the fruit is smaller than that of the former, but the bunch is supplied with a much greater number of plantain-fingers, averaging about 60 and 80, but sometimes from 100 to 130. This species is regarded as more delicate than the others, particularly when ripe. *Dominica* plantain: this is a variety of the latter; though the body is exactly like that of the *horn* plantain, the bunch, however, resembles that of the *French*, but the fruit is somewhat shorter and plumper."

Cultivation.

The fruit-bearing Musas, require a moist and uniform heat. They do not necessarily require an abundance of light, as many will grow in the shade of trees. They require, however, a deep rich soil and newly cleared forest land, containing plenty of vegetable mould. Outside the torrid zone the plants are chiefly ornamental, as they cannot be depended upon to produce fruit in anything like the profusion they do in the tropics. In cool countries also bananas do not grow continuously as in the tropics, but they have a resting period during the winter when the leaves cease to develop, or even partially wither. They break forth, however, on the return of warm weather. In such a case the life of the plant extends over a longer period, and stems, which usually last only a year, may live for two or three, or until fruit is produced. In many countries, even in the tropics, where the plants are liable to injury from hurricanes, their cultivation is either wholly abandoned, or only dwarf sorts are grown, like the Chinese bananas, under shelter of houses or walls. In spite of the usually luxuriant growth of bananas and plantains, they yield very poor crops in land that has long been under cultivation, and where the humus is exhausted, even though the soil remains productive for other plants, such as sugar-cane, cassava, maize, millet, and sorghum. In very sandy soils the banana may flower, but it produces no fruit. Abundant, but not stagnant, moisture in the soil is necessary, and the finest plants are generally seen on the banks, and in the neighbourhood of streams. Kurz states that " transplantation of the shoots improves the quality of the fruit." This may mean either that the shoots should be severed from the parent stem and planted singly, or that it is an advantage to exchange shoots from one district to another. It has been proved in the West Indies that bananas grow most luxuriantly in warm, moist valleys, shut in amongst the mountains. There they succeed better even than in the open plains, probably on account of the shelter they obtain and the moister climate. They grow on mountain slopes up to elevations of 3,000 to 4,000 feet, but they begin to lose some of their vigour long before they reach the latter elevation. The growth is slower, and the bunches are not so large nor so abundant. A mean annual temperature of 75° to 80° Fahr. appears to suit them best ; although Dr. Ernst states that he has seen a plant of *Musa sapientum* laden with full, ripe fruit, near Caracas, at a height of 5,175 feet, with a mean annual temperature of 66·2° Fahr. Lieutenant Parish found two or three banana plants cultivated in an enclosure at an elevation of 5,400 feet on the Chumba range in the Himalayas. Considering the latitude this is probably the highest limit of cultivation in Northern India. Further south, in the Nilgiris, Kurz says a small wild banana grows on grassy plateaux at an elevation of 7,000 feet. There are seeds in the Kew Museum of a wild *Musa* from the elevated plateau of the Wynaad which may be allied to this.

Firminger records that plantains were growing at Firozpur in 31° N. lat., " but there is little probability of obtaining good fruit from them so far north, as the frost cuts down the plants in the cold season, and they only recover themselves, so as to begin to bear fruit, when the cold season comes round again, and they are unable to mature it."

At the same latitude, however, in the insular climate of Bermuda, in the North Atlantic, Jones mentions both the plantain and banana

amongst the cultivated fruits of the Islands. He adds, "there is also a dwarf variety," possibly the Chinese banana (*Musa Cavendishii*).

In Borneo, Burbidge says :—

"That most generous of all food-giving plants, the banana, is everywhere naturalised in Borneo up to an altitude of 3,000 ft. It fruits all the year. . . ."

Seemann, in the *Botany of the Herald*, p. 336, speaks of *M. sapientum* as succeeding well in the lower coast of north-west Mexico, "but it never bears fruit at Durango, 24° N. lat., where it is cultivated only for its ornamental foliage."

It is recognised everywhere that the dwarf banana (*M. Cavendishii*) does not require so much heat as varieties of *M. sapientum*, and on this account it is usually selected for cultivation in sub-tropical countries.

"This sort," remarks Sagot, "I have seen in the Canaries, cultivated in abundance, with the help of irrigation. It grows well, and gives an abundance of fine spikes. The growth is suspended from November to April ; its leaves, however, remain green and fresh, and unless the wind, too much laden with saline spray from the sea, blackens them." In Algiers the banana is merely cultivated as a curiosity in some of the gardens near the coast. *Musa Ensete*, however, grows well there, and fruits freely. In lower Egypt, according to Bromfield, the banana succeeds well, but it is principally confined to the gardens of the wealthy.

In what are known as the Gulf or the Southern United States of America, just outside the tropics, the banana is often grown, although fruit is not expected more than once in four or five years. It is met with in the open air (in sheltered gardens) from Southern Texas to South Carolina. In Florida its culture for profit is not carried on farther north than Putnam County, and even in parts of South Florida there are few large patches, though nearly everyone has a few plants. The fruit is generally inferior in quality compared with tropical fruit. Often, as in the severe frost of 1886, all the banana plants in Florida are killed to the ground. In the exceptionally mild climate of California in N. lat. 34° (corresponding to that of Cyprus), bananas have ripened in the open air, as, for instance, at Tustin in Los Angeles County. The principal Musa grown in California is the ornamental Abyssinian banana (*Musa Ensete*). This has produced seed from which plants are now growing in many parts of the State. The Abyssinian banana also flowered and fruited at Palermo in South Europe in 1873. The flower spike was over 5½ feet long. The seeds ripened and produced plants. A plant at Parc Monceaux near Paris also flowered in the open air, but did not produce fertile seed.

As to Australasia, in New Zealand, Tasmania, Victoria, the southern parts of South Australia and Western Australia, the climate is too cold for growing bananas for fruit purposes. In the more tropical parts of New South Wales, in S. lat. 28° to 30°, the banana is said to "grow well and produce excellent fruit, some localities being better suited than others . . . . but notwithstanding the ease with which the plant can be grown very few settlers seem to grow it." In Queensland, and especially the northern parts within the tropics (as also in corresponding parts of South and Western Australia), the banana flourishes with great luxuriance.

The cultivation of "plantains" in India is thus discussed by Firminger (*Gardening for India*, p. 178) :—

"The plantain delights in a very rich soil. Plants should be put out 6 or 8 feet apart in a trench, about a foot or more deep and 3 feet wide, which should be well supplied from time to time with fresh cow-dung,

and abundantly watered. There should not be allowed to remain more than three stems to each plant, and the suckers, which will be constantly springing up, should be removed as soon as they make their appearance. The stem that has once borne fruit should be cut down close to the ground, as it will never bear a second time, and a fresh sucker should be allowed to grow up to replace it. The plantain, however, as it appears to me, soon wears out the soil in which it grows, and is immensely benefitted, I consider, by removal about every two or three years into entirely new ground."

In **Ceylon** the cultivation of bananas is almost entirely in the hands of natives who grow them around their dwellings for shade as well as for the fruit. The *Ceylon Directory* states that while the mango, jambu, and several other fruits are particularised in the *Mahávansa* (a metrical chronicle in Pali of Ceylon from B.C. 543 to A.D. 1750) no mention is made of the plantain. The area under cultivation now in the island is said to be not less than 24,000 acres. "It affords to some extent here, as in almost every other country in which it is grown, an excuse for idleness. Dilke calls it 'the devil's agent' so little labour is required for the rich return in fruit." In the absence of a market abroad for the fresh fruit, only enough is grown to supply local wants.

In 1892 the "Jamaica banana" (known also in the West Indies as the Martinique banana, in Dominica as the *figue la rose*, and in Trinidad as the *Gros Michel* banana) was successfully introduced through the aid of Kew from Jamaica to **British New Guinea**. Sir William MacGregor, K.C.M.G., in acknowledging the safe arrival of the shoots and suckers, mentioned that in September 1892 they were growing at the Government Station in the Mekes district. He adds, "I have hopes that in the future they may become a valuable export from this place."

A great many different kinds of Musas are cultivated in the Islands of **Polynesia**. They may be arranged in two natural groups under the native names "fei" (*Musa Fehi*, Vieill.) and "maya" (*Musa sapientum*).

The dwarf or Chinese banana, known in Fiji as "Vudi ni papalagi" (*i.e.*, foreign banana), though introduced, as already mentioned, within the last 50 years is now widely cultivated everywhere.

In 1889 the Governor of **Fiji** reported that "the quantity of bananas exported from the islands is now considerably over half a million bunches per annum, and in the Colony the trade may be said to have been thoroughly established."

As described by Mr. John Horne, F.L.S., in *A Year in Fiji*, p. 81 :—

"Banana plantations abound everywhere, and extensively so in Colo, in the mountain districts of Viti Levu. They are planted along the sides of the road to shade the traveller from the sun, sometimes forming avenues miles in length or more. The fruit on these trees is *tabu*, that is forbidden to travellers. The *tabu* is invariably respected by the natives.

"Bananas are planted in rows, 8 feet apart, and the same distance is allowed between each tree. Suckers from the sides of old roots are used as plants, the leaves being cut off before planting. The soil in the place where the young tree is to be planted is dug in a circle of about 3 feet in diameter, and to the depth of 2 feet, and well manipulated."

The Report of the Agricultural and Industrial Association of Fiji for the year 1889 shows that the export value of bananas for the previous year was about 42,000*l.* and there is no reason why it should not be more than doubled. Care and attention have been latterly bestowed

upon the cultivation and selection of the fruit, and when this has been done the banana disease (*Kew Bulletin*, 1890, p. 272, and 1892, p. 48) has not made much headway.

In the year 1891 two Wardian cases of the Jamaica banana, the fruit of which is so largely exported in the United States, were received at Kew from the Botanical Department, Jamaica. These were forwarded at the request of the Governor, Sir John Thurston, K.C.M.G., who was desirous of adding this sort to those already under cultivation in the Colony. After being cared for and repacked at Kew, they were sent to the Botanic Station at Suva by way of Sydney. Many of the plants survived the long voyages to Fiji, and in May 1892 they were reported as "growing apace."

Burton (*Cent. Africa*, ii., p. 58) says :—

"The Mdizi or plantain-tree is apparently an aborigine of these latitudes ; in certain parts, as in Usumbara, Karagwah, and Uganda, it is the staff of life. A single bunch forms a load for a man. It is found in the island and on the coast of Zanibar, at K'hutu in the head of the alluvial valley, and, though rarely, in the mountains of Usagara. The best fruit is that grown by the Arabs at Unyanyembe ; it is still a poor specimen, coarse and insipid, stringy and full of seeds, and strangers rarely indulge in it."

Speke says the plantain or "N'deezee" is the food of the countries one degree on either side of the equator, acres of ground being covered with its groves. On the high lands of the interior it ceases to grow at 2° N. lat.

Amongst the Monbutto, west of **Uganda**, Schweinfurth (*Heart of Africa*, ii., 87) remarks :—

"The growth of their plantain (*Musa sapientum*) gives them very little trouble ; the young shoots are stuck in the ground after it has been slackened by the rain, the old plants are suffered to die down just as they are ; and this is all the cultivation that is vouchsafed. In the propagation of these plantains, however, the Monbutto have a certain knack of discrimination for which they might be envied by any European gardener ; they can judge whether a young shoot is capable of bearing fruit or not, and this gives them an immense advantage in selecting only such shoots as are worth the trouble of planting."

More recently beyond **Yambuya**, in the heart of the great tropical forest, Mr. Stanley (*Darkest Africa*, i., p. 252) found "a clearing three miles in diameter abounding in native produce and hitherto unvisited by the Manyuema. Almost every plantain stalk bore an enormous bunch of fruit, with from 50 to 140 plantains attached. Some specimens of this fruit were 22 inches long."

Also at Indeman (vol. ii., p. 55) : "The plantain groves were extensive and laden with fruit, and especially with ripe mellow plantains whose fragrance was delicious."

And in approaching Adanta and Andikumu "in half-an-hour the main body of the caravan filed in, to find such a store of abnormally large plantains that the ravenous men were in ecstasies."

While at Ngoti above Urigi (vol. ii., p. 383) : "A fine bunch of bananas could be purchased for 10 cowries, and as 8 cowries constituted a day's ration allowance, no one could possibly complain of insufficient food."

Dr. Parke speaks of "grim starvation" and "grim despair" which overtook the expedition (*Equatorial Africa*, p. 113), and rejoices at last in the "great luck" which brought it within reach of the generous

plantain trees. "Just opposite our camp were some plantain trees. On making the discovery all the men were rowed across the river; they returned in the evening with a great quantity of bananas, which were greedily devoured. The men were served with 75 plantains each; they were not, however, very large or substantial; I disposed of 20 at one sitting without any prominent ill-effects."

In Mr. Morris's Report on the Island of **St. Helena**, pp. 26–27, the following note is given on fruit-bearing Musas: "The banana is grown to a small extent, but owing to the destructive influences of wind they do not bear so abundantly as they should. The small Chinese banana (*Musa Cavendishii*) is best adapted for cultivation in St. Helena, but with the exception of one or two plants it does not appear to have been largely tried. Being a small plant, seldom more than 5 to 6 feet high, it would grow well under shelter of a wall or side of a house, and under these circumstances it would be more satisfactory to grow than the taller kinds."

The plantain described as "a highly esteemed vegetable rather than a fruit appears to be absent from St. Helena. At least no plants came under my notice. Suckers might be obtained from the West Coast of Africa. It would require shelter, and a moist and somewhat rich soil. The latter conditions are easily attained in Jamestown, at least by irrigation."

For general notes on the cultivation of the banana and plantain in the **West Indies** reference might usefully be made to Dr. Nicholls' *Tropical Agriculture* (London: Macmillan, 1892), pp. 159–165. It is interesting to note that on the authority of Ovideo bananas were introduced by Father Thomas of Berlangas from the Canaries into San Domingo in 1516, whence they were introduced into the other islands and the mainland of tropical America.

Hughes (*Barbados*, p. 183) gave, so long ago as 1750, a very clear account of the cultivation of the plantain in that island:—

"Before the mother tree decays two or three large suckers or young trees grow up from the root. The largest of these, in about a twelve-month's time, bears such another bunch of plantains as above described; and as this likewise dies, after it hath produced fruit, there springs from the root fresh young shoots; so that there is an annual succession of trees without any trouble to the planter. However, it is thought the most prudent method to replant them once in seven or eight years; in doing this to great advantage the situation must be rich and sheltered from the wind; and the land intended for this purpose must be dug in holes 2 feet deep, 1½ broad, and 12 feet asunder. These being well manured large roots of superfluous plantain trees are cut through in two or three pieces; one of these is put in every hole, slightly covering it with earth, in a short time it springs up. Another common way of propagating these trees is to dig up other young ones, which in great number are to be found growing about the roots of old decaying trees, and cutting off the top of these within 3 feet to the root, and so transplant them into holes prepared for that purpose."

Jamaica.—According to the *Jamaica Handbook*, 1881, pp. 181–182, bananas do well under irrigation near Spanish Town. The cost of clearing the land, opening irrigation trenches, buying suckers at 2*s.* per hundred, planting, cleaning eight times in the year, and all expenses up to the end of the first year was estimated at about 10*l.* per acre. The yield of marketable bunches was 25 per cent. less than the number of suckers planted. "No returns should be counted upon for the first

12 months, and the yield will vary considerably according to the nature of the soil. . . . . One field of 10 acres gave in the second year a return of 240*l.* net, whilst another field of 18 acres gave a net return of only 70*l.*" This disparity was due, not only to an original difference in the character of the soil but to the fact that the latter field had been already cultivated for some years previously, and the vegetable mould (so essential to the growth of the banana) had been exhausted.

In a note by Mr. Henry Cork on banana cultivation, reproduced in the *Bulletin of the Botanical Department, Jamaica* (1893), 49, p. 2, it is stated that plants on level land that can be ploughed are put out at 14 feet square ; the rows are kept perfectly straight. The suckers allowed to remain for future crops are carefully selected at regular intervals, from two to four months (according to the quality of the soil), all others are removed. If too many suckers are left the bunches take longer to mature and hence the fruit will not be ready early in the spring when good prices are obtainable. The land requires to be weeded, ploughed, and harrowed seven times during the year, forked round the roots once a year, and have the redundant suckers removed regularly as they appear. The actual gross returns on good land thus cultivated (with 339 stools to the acre) was 27*l.* 1*s.* 3*d.* per acre. The cost of cultivation and delivery per acre was 6*l.* 18*s.* 6*d.* The net profit per acre was therefore 20*l.* 2*s.* 9*d.* Forty acres of this estate had been bearing since 1886 and were still in cultivation. The net profit realised on the particular estate above mentioned was probably exceptional. On the other hand it shows what high cultivation and judicious management can do in the production of bananas in thoroughly suitable localities in Jamaica.

In **Trinidad** Dr. de Verteuil says :—

"The plantain requires a good deep soil and a sheltered position, being easily prostrated by strong winds. It is propagated by sprouts (improperly called slips) which are planted at 10 feet apart. From five to seven of these young shoots or suckers spring out of and around the parent stem. The fruit, or rather the bunch of fruits, makes its appearance between eight, nine, and twelve months. The young shoots then give their fruit in succession, for two, three, or even many years, according to the climate, fertility of the soil, and the care bestowed on them. A plantain 'walk' requires only occasional weeding and pruning."

In **British Honduras** the cultivation of bananas and plantains has become an important industry. In fact the fruit exports are now almost two-thirds of those of the great staple industry of the colony—mahogany. Further it is stated (*Kew Bulletin*, 1894, p. 98) that "the one cheering fact in the agricultural condition of British Honduras at the present time is the gradual and steady development which has taken place during the last few years in the fruit trade."

In the early stages of this enterprise the following suggestions were offered by Mr. Morris (*Colony of British Honduras*, pp. 92, 93) with a view to establish successful plantations :—

"Owing to the regular fortnightly communication by mail steamer between British Honduras and New Orleans, a large demand has arisen for bananas, coco-nuts, oranges, pine-apples, and various other fruits for the American market. At present, next to sugar, bananas would appear to be occupying chief attention in the Colony, and provided a convenient and regular market is found for the produce, planters have every prospect of finding the cultivation a profitable one.

"The profits on banana cultivation would appear to range from 12*l.* to 15*l.* per acre, after the lapse of 12 to 18 months. The cost of establishing a plantation, including the price of land (at a dollar an acre) will not exceed some 8*l.* to 12*l.* per acre until the first crop is reaped.

"There are some thousands of acres of splendid land suitable for banana culture in this colony, which offer every inducement to experienced tropical planters to settle down and reap the returns which must inevitably attend the judicious and careful culture of this fruit. Practically, the export trade in bananas has only arisen since steam communication was established with America. The export in 1880 was 8,958 bunches of bananas, of the value of 700*l.*; in 1881 it had risen to 22,229 bunches, of the estimated value of 1,469*l.*"

[It has since attained large and increasing proportions, and the annual value now is not less than 40,000*l.*]

A later account, written from personal experience, of banana planting in British Honduras, was contributed to the Demerara *Argosy* by Mr. W. Van Diepen. The chief points of interest may be briefly summarised as follows:—*Planting:* The suckers are put out at 18 feet by 18 feet. This wide planting is claimed to be ultimately advantageous in producing fine large bunches as well as in affording space for the cultivation of cacao, rubber, and other plants of a more permanent character. Bananas so planted give 134 stools to the acre. The largest suckers only are used and care taken not to injure the eyes. When suckers are produced all except two or three of the strongest are recommended to be destroyed. "This is done by bending them down, and on no account should a cutlass be used, as cutting them down bleeds them, and consequently takes away the strength of those left."

Reaping: The bunches should be left on the trees, if possible, until the day before shipping. During the cooler months, November to April, the bananas are cut much fuller than during the hot months. "Fruit cut too full in the summer does not last the four days' voyage to New Orleans." The period which usually elapses from the time the sucker is planted until the bunch is reaped is twelve months. "After the bunch is cut the planter may with safety expect two or more bunches from shoots on the same stool during the next nine months." Each bunch may weigh from 30 to 90 pounds.

Replanting: Unless the banana plant is required to shade other plants the fields should be re-planted every five years.

Protection from wind: High winds are injurious to banana crops. Hence cultivators should leave a belt of forest and under-bush to protect the plantation on the north and east. Stems with large bunches should be supported by sticks or bamboos.

Shipping the fruit: Winter is the best market time for bananas in the United States, the fruit keeps longer in good condition for the voyage and subsequent handling on land. In order to obtain fruit in December the grower should plant at the end of November, that is, 12 to 13 months previously. The months of June, July, August, and September are the worst for shipping bananas. In British Honduras the contractors pay 50 cents, Belize currency, equal to about 1*s.* 6*d.* for bunches of eight hands and upwards, and half that price for bunches under eight hands; bunches of six hands are very seldom saleable.

The United States Consul at Belize in 1893 reported: "The capital required to start a fruit plantation is comparatively small, and, the

revenue gained from it when in full bearing being large, many men who were formerly labourers now own plantations on the banks of the various rivers and also comfortable town houses. All the fruit grown here is shipped to the United States, and the steamers which buy the fruit from the grower bring in exchange all the food stuffs which are consumed in the Colony."

The later developments in fruit-growing in **Nicaragua** are described by Mr. Consul Bingham, in a Foreign Office Report, No. 92, 1888, on the cultivation of bananas on the Rama River, Nicaragua :—

"The first shipment, consisting of about 500 bunches, was made in the latter part of 1883, the fruit being sold at the vessel's side at the rate of 50 cents (Nicaraguan currency) per bunch. The success that attended this first attempt induced many persons, including several foreigners, to commence the cultivation of bananas, and now the whole of both banks of the Rama River, commencing from about 20 miles from the Bluefields Lagoon up to the junction of the Rivers Escondido and Sequia, and such parts of the last-named rivers as are navigable for canoes, have been cleared and cultivated. The banks of the Rama River, for about 20 miles from Bluefields, are not adapted for cultivation, being too low and swampy. The following figures will show the rapid growth of the exportation of bananas from this country :—In 1883 the number of bunches exported was 8,000 ; in 1884, 40,000 ; in 1885, 45,147 ; in 1886, 154,434 ; and in 1887, 255,332.

"To ship the bananas during the year 1887 there were six steamships, each making monthly trips to the United States, where the whole of the fruit is sold, two of these steamers carrying their cargo to New Orleans, three to Baltimore and Philadelphia alternately, and one to New York.

"A plantation of 10,000 bananas would cost, including clearing the ground and planting, about 10,000 dollars currency. It would commence to give fruit in 9 or 12 months after planting, and would last about five years ; after that time the ground becomes exhausted, and the fruit so poor as to be unmarketable. The bananas grown on the Rama River are the ordinary yellow banana, about 6 to 8 inches long, and a red variety known as the 'patriota.' This is smaller than the yellow form, but has a sweeter and finer flavour."

In **Venezuela** Diaz states that the plantains and bananas of that country thrive very well, the only drawbacks in certain localities being strong winds and occasional prolonged droughts. The soil best suited to them should be somewhat moist and provided with humus. As regards temperature the hotter it is (with abundant moisture) the better ; hence the luxuriance of the plants along the sea coast.

In propagating it is important the suckers should not be removed until the parent stem has perfected its fruit, otherwise the latter will not fully mature. Suckers are put out at a distance of 9 to 12 feet, according to the fertility of the ground, and they are disposed "in equilateral triangles." During the first year the ground could be utilised for the growth of maize, peas, beans, and other crops between the rows. The weeding and clearing should take place at the beginning of the rainy season and again "at the commencement of the north winds," that is twice a year, in the months of April and September respectively.

At **British Guiana** Messrs. Harrison and Jenman write :—

"The banana is a gross feeder and requires liberal cultivation. A copious rainfall, good soil and tillage, free drainage, and liberal dressings

of manure where the ground is permanently used, are all essential conditions to the production of first-class fruit. When stable dung is procurable its application pays well. In the experiments we have tried with artificial manures, sulphate of ammonia, applied about 2 cwt. to the acre at a time, appears to have produced the best results. Enormous show bunches of any of the heavier yielding kinds may be obtained by planting in a stable-manure heap or ordinary dung-hill. One caution may be mentioned. The plant tillers (or suckers) so freely that constant attention is required to keep down the superabundant shoots. The taller kinds should not exceed 300 stools to the acre, and if allowed to 'ratoon' much, less would be advantageously planted. The small fig and the dwarf or Chinese may be placed closer, but not if many suckers be allowed to grow. As the bunches of the latter hang down nearly to the ground, all animals, including poultry, must be kept away from them. The tall kinds should be supported with a forked stick or two, placed under the neck of the bunch on the side which it hangs and leans to, strong enough to support the weight.

"Plantains require much the same system of cultivation as that described for bananas, but give a heavier yield from the same land. They delight in the stiff, newly empoldered clay lands of this colony, not objecting to the slightly saline element found where the sea or river has invaded the place periodically at spring tides while it was lying fallow under the natural bush growth. Such lands yield heavily, but the crop is liable to suffer, if the seasons for the first two years after planting prove very wet, from the plantain disease of the colony."

Again "new lands produce the most luxuriant plantain growth, and are used for this purpose by estates, as they will not at first grow canes well, but after a few years of plantain and ground provision cultivation they become adapted to the requirements of sugar-cane cultivation. Plantains growing on 'pegass' land (containing a large admixture of vegetable mould) are reported to be better flavoured than those grown on purely clay land, upon which, however, for commercial purposes they are almost exclusively grown."

Mr. A. D. Van Der Gon Netscher, when proprietor of plantation *Klein Pouderoyen*, on the west bank of the River Demerara, in 1855, furnished the following interesting particulars relative to the cultivation of the plantain: "The experience of ten years on a cultivation of from 400 to 480 acres in plantains has shown that—1. On a well kept cultivation every acre will give 300 good and 50 inferior bunches of plantains per annum. 2. On every acre 400 suckers are planted at intervals of 12 feet, in rows nine feet apart, a closer planting having proved to be injurious to the growth of the fruit and the development of the stem. 3. Of the suckers planted not more than 75 out of 100 succeed, and the deficiencies require to be supplied. The cultivation will give on an average five good crops of fruit in two years. 4. The keeping up of a plantain estate, on a large scale, costs about 6*l*. per acre per annum, supposing the estate to be already in good working order."

Cultivation of Bananas in England.

Bananas are common objects of cultivation under glass in this country, but they are grown more for their handsome foliage than for the fruit, since they occupy considerable space in hot-houses, and require

a high temperature all the year round. At Kew, Sion House, Chatsworth, and many other establishments with spacious "palm" houses, plants of large size are grown, and under these circumstances they fruit freely.

M. Ensete and *M. Basjoo* form very striking plants at Kew in the Temperate House. *M. Ensete*, according to Sir Joseph Hooker (in *Gard. Chron.* 1860, p. 1105) ripened a few seeds in the Palm House in that year. The female flowers were specially fertilised with pollen taken from the scarcely opened male flowers. The Palm House affords the most suitable conditions for the tropical species. Some fine specimens of *Musa sapientum* attain a height of 18 feet to 20 feet. Their large, emerald green leaves remain unbroken, in marked contrast to their usual condition in the tropics, until they begin to fade. The most esteemed sorts for fruit purposes are selected from time to time for distribution to botanical institutions in the Colonies. Of these the "champa" and "râm kela" (or *rubra*), two choice Indian sorts described by Firminger, have been distributed from Kew during the year 1893. A Malayan sort, "pisang medji" (*M. mensaria*, Rumph), with a sub-globose fruit, as large as an apple, and soft yellow flesh is very palatable. Another Malayan sort "pisang raja" (*M. regia*, Rumph) with a fruit as long as a man's finger, an inch thick, is very sweet and delicate in taste. To these may be added a sort from Madras called "rustali," generally sold as a table plantain in that Presidency, though by some it is not thought of such good quality as the "guindy."

A bunch of the Chinese banana grown by Sir Henry Peek, exhibited at a meeting of the Royal Horticultural Society in 1877, weighed 98 pounds, "a result," according to the *Garden*, XI., p. 345, "which proves that we may enjoy this, and possibly other tropical fruits, fresh from our own garden, if we desire to do so."

Graham (*Bot. Mag.*, t. 3849) refers to the success which had attended the cultivation of many forms of bananas, at Edinburgh in 1840, under the management of Mr. McNab, and he specially mentions the immense quantity of high-flavoured fruit which had been produced.

At Parkfield, near Worcester, according to the *Gardeners' Chronicle*, 1894 [1], p. 340, two plants of *Musa Cavendishii* "were carrying clusters of fruit weighing between 80 and 100 pounds each.

Mr. W. Watson, the Assistant Curator, gives a brief account of the treatment of bananas at Kew as follows :—

"A selection of edible-fruited Musas is cultivated in the Palm House at Kew, in addition to the collection of species, of which 20 of those recognised in this paper are represented in the various houses. With scarcely an exception they are all easy to cultivate ; they like rich soil, a fair allowance of root-room, plenty of sunlight, and liberal supplies of water. The deciduous species, represented by *M. superba*, are kept quite dry during winter. *M. Cavendishii* does not fruit as well in the Palm House as it does at Sion House and in other gardens, but all the forms of *M. sapientum* fruit well at Kew. They are planted either in large tubs or in a border on the south-east side of the house in a compost of rich loam and cow manure. Suckers about 6 feet high, when planted singly, fruit in from two to three years. The bunches are cut as soon as the fruit shows signs of changing from green to yellow and hung in a warm room to ripen. This they do in about a fortnight after cutting. Fruit ripened on the plants is not nearly so rich in flavour as when it is cut and ripened in a room ; it also ripens much more slowly if left on the plants. As soon as a bunch is

cut the stem which bore it is cut off level with the ground and a sucker of which there are generally several in various stages of growth, is selected to take its place.

"Travellers who have tasted some of the best of the Kew-grown bananas, say that they are superior in flavour to what are obtainable in the tropics."

Mr. George Wythes, gardener at Sion House, has lately given the results of his experience in growing bananas, in the *Garden*, Vol. XLIV., pp. 496–497. One of the best sorts recommended to grow for fruiting purposes is the Chinese banana, *M. Cavendishii*. A sort grown at Panshanger Gardens called Lady's Finger is also described as a first-class fruit with an excellent flavour. The taller sorts are not in favour in conservatories as they take up too much room.

"When grown in a high temperature bananas require an abundance of moisture. Plants may be fruited in 12 months if well cultivated and large suckers are planted in the first instance. They like good stout loam and an abundance of food. As soon as the fruit is formed surface dressing with cow manure is recommended and Thomson's vine manure mixed with the compost. Fish manure is also excellent. After fruiting the old stem or stool should be removed and the sucker detached. The border is then cleared out and filled with new soil for subsequent planting."

The plantain is not usually grown under glass for the sake of its fruit. Should it be accidentally introduced and fruited it is regarded by those not acquainted with its merits as simply an inferior sort of banana and it is discarded. If there were such a plant as a dwarf plantain yielding a first-class fruit suitable for cooking it would be very desirable to introduce it.

Diseases of Plantains and Bananas.

As a rule, both plantains and bananas are singularly free from disease. Taking into account the immense areas over which these plants are cultivated, and the lengthened period during which they have been subject to the control of man it is remarkable that no chronic disease has manifested itself amongst them except in one or two localities.

Queensland.—Dr. Bancroft in 1879 investigated a disease in the neighbourhood of Brisbane. The plants were said to be *Musa maculata*, the *figue mignonne* of Mauritius and Bourbon, and the "sugar banana," possibly a form of *M. sapientum*. He found the roots affected with what he called the "flash worm," a species of nematoid worm allied to the well-known paste eel *Anguillula*. He recommended as a remedy "ploughing up and summer fallow." Of late years little has been heard of this disease. Nothing apparently is so efficacious as changing the ground from time to time and planting with healthy suckers from unaffected districts.

A fungus (*Glœosporium Musarum*, Cooke and Massee) affecting ripe bananas in Queensland was forwarded to Kew by Mr. F. M. Bailey, F.L.S. (No. 520). This disease is capable of spreading very rapidly on living plants, and as a "black smut" it may be readily detected. The only effective treatment is to destroy the plants immediately by burning or by the liberal use of lime.

Fiji.—In the Governor's report for the year 1889 it was stated, "A disease has appeared among the banana plantations in these islands

during the past six or seven years, and it would make rapid strides but for the persistent watchfulness of the growers. No reliable cure has yet been found, but inquiry and experiment are still going on." The subject was discussed in *Kew Bulletin*, 1890, pp. 272–273.

Sir John Thurston stated that the disease broke out in the first instance on the small island of Yanuca, used as a quarantine station. It is possible it was introduced in some way by immigrants. It spread from Yanuca to the neighbouring island of Moturiki. Here *Musa Cavendishii* (largely grown in Fiji for export), was first attacked, but in the course of a few months the larger and stronger plantain was affected, and ultimately not a single banana or plantain could be found from one end of the island to the other. The disease then passed over to Viti Levu and was carried by various agencies all over the country. No place, however, suffered as Moturiki did. The Governor was able to report in 1891 that after a period of rest the land even there was able to grow plants almost free from disease.

It was believed that the Fiji disease might be caused by a nematoid worm, a minute parasite similar to that found in Queensland attacking the roots. It was recommended, failing success with various insecticides, to plough the land, leaving it fallow for a time and alternating some other crop. The ground was subsequently to be replanted with suckers from an unaffected locality. The view that the disease was caused, in part at least, by nematoid worms was apparently confirmed by investigations with fresh material undertaken by Dr. N. A. Cobb at Sydney, New South Wales. The results are given in *Kew Bulletin*, 1892, pp. 48, 49. The remedies suggested by Dr. Cobb were :—

"1. Where the bananas are cultivated, a system of rotation should be adopted ; no attempt should be made to grow banana plants on the same ground continuously for a long series of years. . .

"2. Judging from the specimens sent, the soil about the banana plants is infested to an extraordinary degree with nematodes, therefore it is best, in cultivating, to plough deeply, or to occasionally subsoil the land. These nematodes attack the roots of plants, and exist largely within 8 inches of the surface. As they become rarer as the depth of the soil increases, it follows that if the land be ploughed deep and thoroughly so as to turn the soil exactly bottom side up, a soil comparatively free from nematodes will be brought to the surface, and, at the same time, the nematodes which were near the surface are buried so deep that they can do much less damage than they could if left at the surface.

"3. . . . The main difficulty in dealing with these plants is thought to be due to the attacks of the fungus, and here the best remedy is great care in setting the new suckers, *i.e.*, in making new plantations. The presence of the fungus is indicated by discolouration in the rootstock. Now, when suckers are cut off from the old plant with a spade, they should be inspected, and all brown and rotten portions should be carefully removed, and all suckers from which these brown and discoloured portions cannot be removed should be discarded."

British Guiana.—A disease of plantains has long been known in this Colony. Diseased stems exhibit internal decay, the substance of the leaf sheafs "turning to a sodden, offensively-scented, putrid mass." The fruits produced by the diseased plants "are black inside, but not soft like the interior of the stems and rootstocks of the plants. They are of course unfit for food." The nature of the disease, according to Mr.

Jenman, has not yet been determined, though it has been studied closely in the fields, and samples of the affected parts have been examined by mycologists. Very wet weather materially increases its prevalence on heavy new land, and good drainage and high planting can be resorted to as a protection from its ravages. It is said that cocoa-nut palms in British Guiana are affected by the same disease as the plantains.

An obscure disease of cocoa-nut trees at Montego Bay, Jamaica, may be related to it. Mr. Fawcett, describing the Jamaica trees, states, "in almost all the trees examined the sour smell of a putrefactive fermentation was very noticeable, and I am of opinion that the disease is due to an organised ferment which is able to attack the very tender tissues of the youngest parts even outside the terminal bud. If this ferment can be destroyed by fire or other means before it reaches the terminal bud in the heart of the cabbage the tree may be saved." The only remedy at all effective was "burning the leaves on the trees in the early stages of the disease." It was recommended to destroy all diseased trees, and for those under treatment it was suggested to apply to their roots the ashes of the burnt leaves mixed with some manure.

The bananas in British Guiana are apparently not affected in the same way as the plantains. Some plants here and there growing near diseased plantains are affected, but the bananas as a rule are free from disease.

As far as can be gathered the plantain disease is more pronounced on the "newly empoldered clay lands of the Colony." This land, with stiff, tenacious soil, is strongly impregnated with salt, and it will not grow sugar canes. It is possible such conditions may serve to render the plantains susceptible to the disease if not directly the cause of it. It has been shown that plants affected by the disease grown experimentally in the Botanic Gardens at Georgetown, in comparatively poorer but drier and more cultivated soil, have "lost the affection from the first, and bore "without exception sound fruit."

Trinidad.—The following information by Mr. J. H. Hart, F.L.S., on this subject is taken from the *Bulletin* of the Royal Botanic Gardens, Trinidad, No. 21, January, 1894 :—

"For some two or three years past a disease has appeared among the various kinds of Musas cultivated in Trinidad. It is characterised by a diseased condition of the leaves, and by the fruit rotting before coming to maturity.

"The kinds most affected are those known as the 'Moko,' or 'Jumbi plantain,' and the 'Jamaica banana,' otherwise known in Trinidad as the 'Gros Michel,' which is the kind most generally exported to the United States.

"I have several times examined diseased plants at various seasons, but so far am unable to point to any special cause. When first affected the plant shows signs of disease by the decay or shrivelling up of its leaves, and a general weak appearance ; the base of the petiole also rots away into a state of fermentation. The watery sap of the plant teems with amœboid organisms, and nematoid worms are present in large numbers, while a variety of forms of bacteria are present in the fluids of both stem and leaf.

"These organisms also appear in the soil surrounding the roots, and also in the fruit when it decays. I have, however, been unable to show that the plant is attacked by parasitic fungi of any kind.

"So far as my observation goes the disease first attacks the growing parts of the plant, and then induces decay downwards to the roots, the whole stem eventually rotting.

"As a tentative measure I would suggest the complete destruction of infected plants, and the removal of all that are healthy to well-drained and fertile soil.

"It is observed that the 'fig-sucré,' or small-fruited banana, enjoys the greatest immunity from attack ; possibly on account of the harder character of the epidermis in this variety."

South-East Africa.—Although the fruit-yielding Musas are not cultivated to any extent in Cape Colony, specimens of diseased banana fruits were received from Professor MacOwan in 1893 grown near East London. The disease was very similar, if not identical, with that caused by a species of *Glœosporium* in Queensland. It affects both the flowers and fruit, and seems to be general. A growing plant infected in the Laboratory at Kew with the spores of the fungus soon showed the disease in a virulent form. It is therefore desirable to carefully watch banana plants affected by any forms of "black smut," and to destroy them immediately, before the disease has had opportunity to spread.

Economic Uses.

Ripe bananas, especially the delicate sorts, are an excellent dessert fruit, and they are universally used in the tropics. The taste and flavour of the banana fruit are very various. Some are acidulous, others acid-sweet or sweet like sugar. In the best varieties the pulp is soft and melting, with a delicate fruity flavour resembling apple, strawberry, or pine-apple. The taste for ripe bananas of late years has largely spread to temperate countries, and to supply the demand an enormous trade has sprung up between the West Indies, especially Jamaica, and parts of Central America, to ship fresh fruit to the United States and Canada. During the year 1893 the aggregate quantity received at ports in the United States reached nearly 13 million bunches. The value of this fruit at the wharf would not be far short of four millions sterling. The quantity received at ports in the Dominion of Canada is not given, but it must be steadily increasing since direct steamers have now been placed between Canada and the West Indies. The consumption of bananas in this country and on the Continent is as yet comparatively small.

Dampier, during his "New Voyage round the World," 1679 to 1691, recognised the value of the plantain and banana. "The plantain," he says, "I take to be the king of all fruit, not except the coco[nut] itself. The trees are not raised from seed (for they seem not to have any) but from the roots of other old trees. If these young suckers are taken out of the ground and planted in another place it will be 15 months before they bear ; but if let stand in their own native soil they will bear in 12 months. As soon as the fruit is ripe the tree decays."

Again, "When this fruit is only used for bread, it is roasted or boiled when it is just full grown, but not yet ripe, or turned yellow. . . . Sometimes, for a change, they eat a roasted plantain and a ripe raw plantain together, which is instead of bread and butter. They eat very pleasant so, and I have made many a good meal in this manner. Sometimes our English take six or seven ripe plantains, and, mashing them together, make them into a lump, and boil them

instead of a bag-pudding, which they call a buff-jacket; and this is a very good way for a change. This fruit makes also very good tarts; and the green plantains sliced thin, and dried in the sun and grated, will make a sort of flour which is very good to make puddings. A ripe plantain, sliced and dried in the sun, may be preserved a great while, and then eats like figs, very sweet and pleasant. The Darien Indians preserve them a long time, by drying them gently over the fire, mashing them first, and moulding them into lumps. The Moskito Indians will take a ripe plantain and roast it; then take a pint and half of water in a calabash, and squeeze the plantain in pieces with their hand, mixing it with the water; then they drink it all off together; this they call *mishlaw*, and it is pleasant and sweet and nourishing, somewhat like lambs-wool (as it is called) made with apples and ale; and of this fruit alone many thousands of Indian families in the West Indies have their whole subsistence."

Coming to later times Lunan in *Hortus Jamaicensis*, p. 74, quoting Labat, says: "When the natives of the West Indies undertake a voyage they make provision of a paste of banana, which, in case of need, serves them for nourishment and drink; for this purpose they take ripe bananas, and, having squeezed them through a fine sieve, form the solid fruit into small loaves, which are dried in the sun or in hot ashes, after being previously wrapped up in the leaves of Indian flowering reed. When they would make use of this paste they dissolve it in water, which is very easily done, and the liquor, thereby rendered thick, has an agreeable acid taste imparted to it, which makes it both refreshing and nourishing."

In the green state and cooked in various ways plantains supply the staple food of millions of people in tropical America. In fact "they are so extensively consumed as to almost take the place of cereal grains as a common article of diet. About 6½ pounds of the fruit or 2 pounds of the dry meal with a quarter of a pound of salt meat or fish form in the West Indies the daily allowance for a labourer." In Jamaica the working negroes prefer plantains to bread; the former they boil or roast in ashes and eat when quite warm. The ripe fruit when it is yellow and has acquired a sweetish flavour is sliced and fried or baked. It has then a pleasant sweet flavour, slightly acid, and very much resembling baked apples.

In Central America, according to Seemann, the plantain furnishes the inhabitants with the chief portion of their food. Similarly we have the testimony of Belt that "Next to maize, plantains and bananas form the principal sustenance of the natives in Nicaragua. There are a great many varieties of them, and they are cooked in many ways, boiled, baked, made into pastry, or eaten as a fruit. The varieties differ, not only in their fruits, but in the colour of their leaves and stems."

Usually the bunches of fruit, both in the plantain and the banana, are cut before they are quite ripe, or when the first fruits are beginning to turn yellow. They are then hung up to ripen gradually under cover. There are, however, other methods adopted. The plantains especially, are sometimes taken from the bunch and packed loosely in a hole in the ground and well covered over. In this way they become softer and have a better appearance than if dried in the sun. When a hole is not available they are placed in a barrel in straw and also covered over. Monteiro, who travelled in Angola, refers to the domestic uses of the fruit as under:—

"The plantain is roasted green when it becomes quite dry and a good substitute for bread; or boiled, to eat with meat instead of potatoes; and when ripe roasted whole or cut lengthways into thin slices and fried in butter and eaten with a little sugar and cinnamon or wine forming a delicious dish for dessert. A very large plantain, 18 or 20 inches long, is cultivated in the interior, and is brought down to the coast by the Tombos."

Speke, in his *Nile Journal*, p. 648, enumerates the uses of plantains in Central Africa: "A chip from the stem washes the hands, and makes the wet flesh-rubber of the Waganda; thread and lashings for loads are also taken from the stem; rain is collected in the green leaves, which can be made into an ingenious temporary pipe; the dry leaves make screen-fences and sacks to hold grain or provisions; the fruit dried (from Ugigi) is like a Normandy pippin; a variety, when green and boiled, is an excellent vegetable, while another yields a wine resembling hock in flavour. At 2° N. they cease to be grown."

In Fiji "The fruit of the different Musas is," according to Seemann, "variously prepared by the native cooks. Split in half, and filled with grated cocoa-nut and sugar-cane, bananas make a favourite pudding (vakalolo), which, on account of its goodness and rich sauce of cocoa-nut milk, has found its way even into the kitchen of the white settlers. Wilkes has already mentioned that the natives, instead of hanging up the fruit until it becomes mellow, bury it (occasionally, it should be added) in the ground, which causes it to appear black on the outside, and impairs the flavour. The fresh *Musa* leaves are used as substitutes for plates and dishes in serving food or for making temporary clothing, the dry instead of paper for cigarettes (suluka). In place of the finger-glasses handed round at our tables after dinner, Fijians of rank are supplied with portions of the leaf-stalk of the plantain."

Seemann continues: "The Fei, or mountain plantain, beaten into a pulp and diluted with cocoa-nut milk or water till brought to the consistency of arrowroot as ordinarily prepared in England, was formerly much used in the Society Islands. Large quantities were usually prepared for every festival; a kind of cistern was made, with a framework of wood and a lining of leaves, which, when filled was a sufficient load for six men to carry. Seven or eight of these were sometimes filled and carried on men's shoulders to one feast."

Moseley in "Notes of a Naturalist," confirms this interesting account of the Fei. In Tahiti he and his companions made "the first camp in the head of Fatua Valley at a height of about 1,600 feet amongst the 'Fei' or wild plantains . . . . The plant is closely similar in appearance to an ordinary banana tree, but the large bunches of fruit instead of hanging down stand up erect from the summit of the stem. They are bright yellow when ripe.

"A fire is lighted and a bunch of these wild bananas is thrown into it. The outer skin of the fruit becomes blackened and charred, but when it is peeled off with a pointed stick a yellow floury interior is reached, which is most excellent eating and like a mealy potato. This is one of the very few plants which, growing spontaneously and in abundance, affords a really good and sufficient source of food to man. Hardly any improvement could be wished for in the fruits by cultivation. It could not but be most advantageous that the plant should be introduced into many other tropical countries."

In the West Indies the dried leaves and prepared portions of the stem are used as a packing material for the fruit when taken down to the

nearest port for shipment. The same material is woven into coarse saddle-cloths for pack mules, or used in a loose pad for the same purpose. The fresh banana leaves are used to shade young coffee or cacao seedlings in nursery beds, and to cover the cacao beans during the process of fermentation. The midribs are often placed in the syrup of Muscovado sugar when first poured into casks to assist to drain the molasses. The young leaves before they open are beautifully smooth and soft, and are used as a dressing for blisters; while the juice, according to Barham, "is good against burn." The water from the soft trunk is astringent and employed to check diarrhœa. The juice from the skin of the green plantain, says Lunan, when cut forms a good cement for broken china or other earthenware. Long remarks that the juice [probably a pectose] which drops from a bunch of bananas hung up in the shade to ripen makes a very good vinegar. Hughes (*Barbados*, p. 182) mentions that "the pulpy stems of bananas are often sliced and given by way of fodder to cattle."

The inner undeveloped leaves, when quite white and tender, as well as the flower or scape buds, are not infrequently eaten in the East Indies. Kurz states that these miniature portions of the plantain (probably from wild plants) are brought into the Calcutta bazaars to the amount of half a ton daily. They are known as *thor* and are prepared for food by boiling. Firminger possibly refers to something similar when he states that "The head of the flowers of a variety of plantain known as *Kuntela* in the neighbourhood of Calcutta before the sheath in which they are enclosed expands, is often cut off, being esteemed a most delicate vegetable." This use does not appear to have extended to tropical America, or at least we have met no record of it, probably on account of the absence there of wild plants in the abundance found in the East. In other parts of India also the young flower-heads are cooked and eaten in curries. The use of these portions of the plantain stems for food is similar to the use in many parts of the world of the leaf buds (or the cabbage) of many palms. There is, however, a curious species of *Musa* already noticed from New Caledonia (possibly altered by cultivation) described by Vieillard under the name of *M. oleracea*. It produces no inflorescence and is cultivated on account of its fleshy and farinaceous rhizomes which are cooked and eaten. It is multiplied entirely by offsets. The infant spadix or scape of the Abyssinian plantain (*M. Ensete*) is also used as a vegetable. The young stem is first of all deprived of all its external envelopes and is then cooked and eaten. "Prepared in this way, it resembles the cabbage of a palm." The plant is of great importance for food purposes as a vegetable in the damp valleys of Abyssinia, notably in the Soudan. It extends also up the Nile Valley almost to the equator. The fruit, as already mentioned, is usually regarded as not edible.

Johnston, however, in his Kilima-njaro Expedition met with a singular use of the seeds of the *Ensete*. He remarks that in the inside of the seeds is a friable white pith easily rubbed into a white powder by the natives. "When in this state it is used for divinations and augury by being blown from the hand." He speaks of the very scanty pulp found in the fruit in a fresh state as "just eatable." It is "faintly sweet, but leaves a somewhat acrid taste in the mouth." Later on he says "it is supposed by the natives that the children grow up fine and tall if they eat of the pulp of the Ensete." A similar belief is said to prevail also among the natives of the Nyassa region. The black irregular-shaped glossy seeds, according to Captain Speke, are strung into necklaces, charms, and tiaras by the Waganda, and goats are fed on the

leaves. Some of the economic uses described under *Musa Ensete* may, however, refer to other, but very closely allied, species.

In India the dried petiole of the plantain is used without further preparation for tying fences, training the betel vine to its support, and for numerous other purposes as a rough kind of twine, and the larger parts are made into little square boxes for holding snuff, drugs, &c. In the Archipelago the trunk is cut into several pieces, which serve as hearths during festivities in the open air, and in Siam it is used for clarifying sugar. The leaves are much used for packing all sorts of small goods in the bazaars, and are also employed as plates, being sold for this purpose for from 1 to 3 pies each. When dry they are employed by shop keepers much as brown paper is in Europe. They are also used for making mats, and as thatch for temporary huts. In Central America "the mats which the poorer classes have to sleep upon are made from fibre of the plantain." In the Malay peninsula the fresh leaves are employed as a water-proof covering for the earthen pots or bamboo, in which rice is steamed. The ash of the leaf and the leaf stalk, rich in alkaline salts, is used instead of country soap or fuller's earth in washing clothes.

A solution of the ash is frequently employed instead of salt in cooking vegetable curries, &c. The shoots and tops of young plants are also occasionally eaten as a vegetable, and are given as fodder to sheep and cattle. The outer sheaths form a valuable fodder for elephants. The central portion of the stem and the root-stock are said to be given to cattle to increase the quantity of milk.

Dr. Dymock found a sweet translucent jelly-like manna exuding from the stem of *Musa superba*. This when dried at a low temperature yielded 82–3 per cent. of fermentable sugar.

Kurz mentions that "the skin of the plantain is generally used by the servants in Dutch India for blackening their masters' shoes." The watery juice which flows from all cut parts of the banana is rich in tannin, and it is of such a blackening nature as to be fit for being used as an indelible marking ink, the marks becoming black and visible only after washing. "One rarely emerges from the cloudy regions of Java (where the undergrowth is chiefly composed of wild bananas) without having his white clothes spoiled for ever owing to the juice that exudes from the injured parts of the banana plants. With the addition of iron it rapidly becomes black like ink."

Kurz further adds: "The *djantongs*, or sterile flower-cones hanging at the end of the scape, of most varieties are used in sayurs and curries, and so also are the flowers themselves in some parts of India." Junghuhn describes a wild plant called the wax banana of Java, the leaves of which are covered on the underside with a minute white powder. The Javanese scrape this meal together, melt it over a fire, and produce a valuable wax. The wax thus obtained becomes very clear, hard, and whitish, and forms an important article of trade in middle Java. Bleaching renders it very white. One banana tree (with seven leaves) yields two ounces of wax. As there are thousands and thousands of plants wild over large areas the preparation of the wax is a remunerative enterprise.

Dye and Tan.—The ashes of the leaves, the stem, and the peel or fruit rind are employed, according to McCann, in many of the dyeing processes practised in Bengal. The latter is also used as a tan and for blackening leather. The sap stains cloth a dark, almost black colour, which is fairly permanent, is very difficult to wash out, and on that account may be employed as a substitute for marking ink.

Amongst the specimens shown in the Kew Museum are the leaves of *Musa Fehi* dried for use as a packing material. The texture of these leaves is stouter than in the ordinary banana. Neat little cups woven from plantain leaves, as well as a native rope from the same material, are shown from Madras. Siamese "burees," or cigarettes, sold in Bangkok at 8*s*. 4*d*. per 1,000, with wrappers made from banana leaves, were received from Mr. F. W. Burbidge. Banana chutney, prepared at Natal, was shown at the Col.-Ind. Exhibition, 1886, while a sample of banana vinegar was received from Fiji at the same Exhibition.

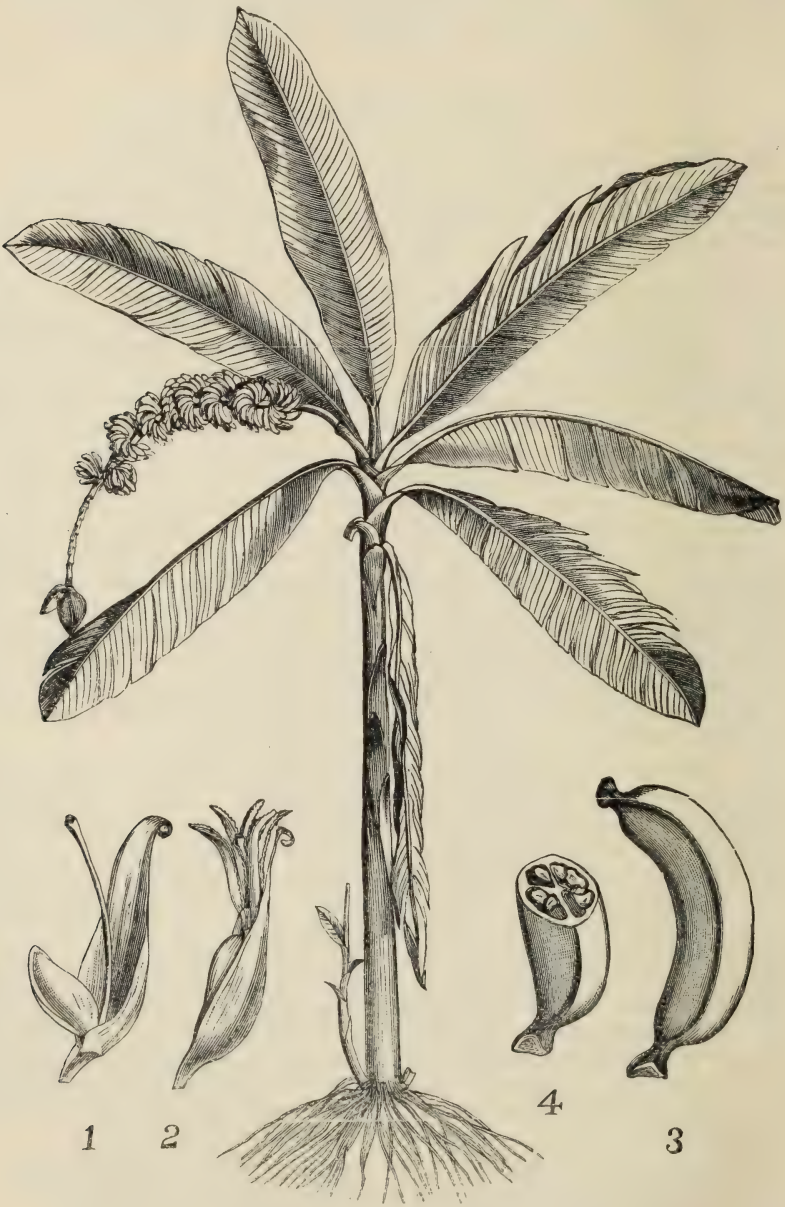
Plantain and Banana Fibre.

The fibre produced by the stems of various sorts of Musa has received attention from the earliest times. Dampier noticed that at Mindanao, in 1886, "the ordinary sort of people wear cloth made of plantain-tree which they call *Saggen*, by which name they call the plantain." To prepare this cloth they cut the plantain stem into four quarters, "which, put into the sun, the moisture exhales; they then take hold of the threads at the ends, and draw them out; they are as big as brown thread; of this they make cloth, which is stubborn when new, wears out soon, and when wet it is slimy." About the beginning of this century the Government of Jamaica offered rewards of 200*l*. "for the best specimens of plantain hemp produced in each county of Jamaica." Dr. Stewart West, then acting-botanist in charge of the Bath Garden, gained the premium for the best specimen produced in the county of Surrey. The particulars are given by Lunan, vol. ii., pp. 75–76. The fibre was cleaned by being passed through a "cramp" fixed in the ground, and hung up to dry as soon as possible. It was pointed out that "the goodness of the fibre depends upon completely evaporating the sap, otherwise the least fermentation greatly impairs its strength; it cannot therefore be too thoroughly dried before it is packed for use or exportation." A nine-thread rope, 1 inch diameter, of plantain fibre made at the Dockyard, Port Royal, broke with a weight of 728 pounds; while a similar rope, known as "the King's nine-thread inch rope," broke by a weight of 714 pounds.

The most valuable *Musa* fibre is undoubtedly that yielded by *Musa textilis*, known in commerce as Manila hemp. There are about 12 different varieties of plants under cultivation all differing in habit and in quality of the fibre yielded by them. They thrive best in fresh clearings of jungle on low hills, and under shade of trees left standing at distances of about 60 feet. They do not do so well in open plains, and in swampy lands not at all. Manila hemp takes the chief place as a material for making white ropes for rigging and other purposes, and old ropes made of Manila hemp make excellent paper material. The magnitude of the industry connected with the Abaca or Manila hemp plant may be gathered from the fact that about 50,000 tons of fibre are annually exported from the Philippine Islands, of the value of about three millions sterling. This suject is more fully discussed in *Kew Bulletin*, 1887, April, pp. 1–3. The fruit of the Abaca is green and hard and unfit for food.

It is important to bear in mind that the Manila hemp plant is exclusively produced in the south-eastern part of the Philippines. All attempts to successfully cultivate it in the western and northern parts have hitherto proved abortive. The plants grew barely 2 feet high,

and the produce never covered the outlay. The cause of these failures in the Philippines (as possibly in other countries where experiments have been made) is attributed to the dry season which continues for several months, while in the eastern provinces there are copious rains all the year round. Evidently the plant will only thrive under the latter condition, and it would be useless to attempt to grow it in countries



Musa textilis, Née.

1. Pistillate flower. 2. Staminate flower. 3. Fruit. 4. Section of fruit showing seeds.

where the rainfall is not large and well distributed all through the year.

There is a very complete set of specimens illustrating the Manila hemp industry in the Kew Museum. Various qualities of the raw fibre are shown from the Chatham Dockyard. In 1864 good fibre was stated to be worth 46*l.* per ton. A sample of "Quilot," one of the two specially selected qualities of Manila hemps, was received in 1890 from Messrs. Ide and Christie. It sells usually about 20*l.* per ton higher than ordinary Manila hemp. A sample of Manila hemp prepared at British Guiana in 1892 was valued at the time at 29*l.* per ton. A "two-inch" Manila rope from the Chatham Dockyard is shown side by side with similar ropes made at Calcutta and Madras. The Chatham rope had a breaking strain of 3,549 pounds. The manufactured articles from Manila hemp consist of mats, cords, hats, plaited work, lace handkerchiefs of the finest texture, and various qualities of paper. The best qualities of stout packing and other similar papers in the United States are made from old Manila ropes. One of the latest applications of Manila hemp is the manufacture of lace and materials for ladies' hats and bonnets. The seat of the industry is at present at Wohlen in Switzerland. The lace for millinery purposes is made from pure Manila (Lupiz) hemp. It is used plain and dyed. The fancy hats and bonnets are woven from similar fibre stiffened and made into various patterns. Some of the hats are made of Manila hemp with a border woven from Sisal hemp. Hats are also made from a straw prepared from several strands of Manila hemp arranged side by side, immersed in gum and pressed. This straw is smooth, polished, and very pliable, exactly resembling the finest wheat straw.

The stems of many of the fruit-yielding bananas and plantains also yield fibre but not of so good a quality. Such fibre has long been used by the natives of India for cordage purposes, for mats, and to a smaller extent for making coarse paper. Dr. Royle devoted a considerable amount of attention to the subject. His conclusion, after numerous experiments, was as follows : "It is evident that plantain fibre possesses sufficient tenacity to be applicable to many at least of the ordinary purposes of cordage. The outer fibres may also be converted into a useful kind of coarse canvas as has been done by Dr. Hunter ; and the more delicate inner fibres most probably into finer fabrics as is the case with those of *M. textilis* when equal care has been taken in the preparation and separation of the fibres, and there is some experience in weaving them."

In Jamaica a series of experiments, undertaken by Mr. Morris in 1884, showed that plantain fibre (*Musa sapientum* var. *paradisiaca*) was whiter and finer than ordinary banana fibre and that it approached more nearly to the fine glossy character of Manila hemp. A banana stem weighing 108 pounds yielded 25 ounces of cleaned fibre, or at the rate of 1·44 per cent. of the gross weight. A plantain stem weighing 25 pounds yielded $7\frac{1}{4}$ ounces of cleaned fibre. This was at the rate of 1·81 per cent. on the gross weight. A sample of fibre prepared from a red banana at Trinidad in 1886 was valued in London at 24*l.* to 25*l.* per ton. Usually, however, banana fibres are not worth more than 12*l.* to 15*l.* per ton. They would only fetch even these prices when there is a high demand for "white-hemp fibres" and there happens to be a short supply of Manila and Sisal hemps. (*Kew Bulletin*, 1887, April, pp. 5–8, with wood cut).

In the catalogue of contributions from British Guiana to the Paris Exhibition of 1867 the following remarks are made in regard to the

prospects of a plantain-fibre industry in that Colony. The figures supplied are very valuable :—

" The fibre of thousands of acres of plantains is lost annually in this Colony from the want of a simple and inexpensive machine for separating it. The tree must always be cut down to obtain the fruit, and the stem containing the fibre is allowed to rot on the ground. Could an efficient and cheap machine be invented, the fibre would be almost entirely profit to the planter. The banana yields less fibre than the plantain tree, and its fibre is generally tinted.

" Various attempts have been recently made to construct machinery for manufacturing the plantain fibre. Subsequently to the Exhibition at Paris, in 1855, strenuous efforts were made to establish the production of fibre in this Colony as an article of export, and the Messrs. Watson had fibre-making machinery put up and tried on their estate, *Haagsbosch*, but it was not found well adapted for the purpose, the stems in their natural state being so much more bulky than was allowed for in constructing the machines.

" Mr. A. D. Van Der Gon Netscher, when proprietor of plantation *Klein Pouderoyen*, on the west bank of the River Demerara, in 1855, furnished the following interesting particulars relative to fibre from the plantain :—The experience of 10 years on a cultivation of from 400 to 480 acres in plantains has shown that—1. On every acre from 700 to 800 stems are cut per annum, either for the fruit, or in consequence of having been blown down by high winds, or from disease or other reasons. 2. The planting of the suckers at distances of 8 feet apart has never been tried ; but I am of opinion that if so planted and cut down every eight months for the stem alone, an acre would give from 1,400 to 1,500 good stems every cutting, or about 4,500 in two years. 3. On plantation *Klein Pouderoyen*, after repeated trials, the plantain stem on an average has been found to give 2½ lbs. clean, and 1½ lbs. discoloured and broken fibre, the latter only fit for coarse paper. This result, however, has been obtained by very imperfect machinery. 4. The average weight of the plantain stem is 80 lbs. 5. The stems can be transported from the field to the buildings for one dollar per hundred."

Owing to the increasing cultivation of bananas in the West Indies, and the fact that when once the stems have borne fruit they are cut down and allowed simply to rot on the ground, some plan might be devised for turning the fibre to account. There are at least 50,000,000 banana stems cut down every year in the West Indies, and at present little or no use is made of the fibre. It is evidently not sufficiently good to compete with first-class rope fibres, but it might possibly be used for making coarse paper, as a packing material, or in the manufacture of *papier maché*. Its chief competitors in some of these directions would be Esparto, and the wood pulp prepared on so large a scale from poplar and other trees in Norway and Sweden. This wood pulp is delivered in this country at a cost not exceeding 2*l*. 10*s*. to 3*l*. 10*s*. per ton, and it is now very largely used by paper-makers.

Banana fibres from *Musa sapientum* are shown in the Kew Museum from the Andaman Islands, Jamaica, Mauritius, Ceylon, British Guiana, Madras, Australia. The Jamaica samples cleaned by the late Nathaniel Wilson are of excellent quality. A sample from British Guiana was valued in 1892 at 25*l*. per ton, but usually the price is much lower, and

when other fibres such as Manila and Sisal hemps are low, banana fibre is practically unsaleable.

The facility possessed by banana fibre for taking up colour is shown in a specimen from Mr. Dickson. Paper prepared from banana fibre and rags is shown from the late Mr. T. Routledge. Also various papers made from banana fibre in India. From Mr. F. S. Reisenberger, in 1886, were received: 1, Half stuff from banana fibre; 2, paper from pure Jamaica banana fibre; 3, paper from equal parts of banana fibre and rags; and 4, paper from banana fibre loaded with China clay. There is also a portion of a leaf, gluten and prepared paper stock from the *pisang utang* from Sarawak, contributed by the late Mr. T. Routledge in 1875.

Fibre extracted from the Abyssinian banana (*Musa Ensete*) at Jamaica by Mr. Morris was yielded at the rate of 1·16 per cent. of the gross weight. The fibre was somewhat weak and dull-looking; it had none of the lustre of the best plantain fibre, and it was valued in London at 12*l.* to 14*l.* per ton.

Musa Basjoo is said to be grown in Southern Japan for the sake of its fibre. It is known amongst Europeans as the "Japanese plantain." The fibre is woven into cloth of an exceedingly durable character. Specimens are in the Kew Museum from Mr. J. H. Veitch, 1894.

Mr. Ridley (*Trans. Linn. Soc.* iii., p. 385), speaking of a new species described by him (*M. malaccensis*) from the eastern coast of the Malay Peninsula in 1893, adds :—

"An attempt has been made to utilise the fibre, but it is apparently not so good as that of *M. textilis*; still as it is not only very abundant throughout the centre of the Peninsula, but also springs up like a weed in many places where old jungle is felled and forms an impenetrable thicket, it will probably be found to be well worth extracting the fibre." A sample of this fibre, as already noted, is in the Kew Museum.

A very interesting series of articles prepared from the fibres of the stem of the banana was forwarded recently to Kew from the Solomon Islands by the Rev. R. B. Comins. The fibre itself is shown in a prepared state, some of it white and some black, ready for weaving. There is a native loom of a very primitive construction, apparently similar to the one used in West Africa for weaving native "pagns" cloths (*Kew Bulletin*, 1894, 191). It is capable, however, with dexterous manipulation of turning out cloth of a close texture and a very durable character. Two garments are shown made from banana cloth ornamented with small tufts of leaves of a *Pandanus*. There are also shown a decorated bag for holding betel and a sleeping mat of full size. On one of the garments there is woven a tasteful pattern by means of the dark-coloured threads. These garments are singularly well made, and they are, next to the Abaca cloth (from *Musa textilis* in the Philippines), the best fabrics in the Museum from bananas and plantains.

A fibre of a coarse character but evidently very strong, marked "Sime firigo," said to be derived from a species of *Musa*, was received from the Government of Queensland in 1890. It was obtained from the Kiwai Fly River, New Guinea.

Lace work ornaments worked with banana thread are in the Kew Museum from Jamaica sent in 1855.

Banana Wine.

The preparation of a palatable drink sometimes called "wine" and sometimes "beer" or "cider" from bananas appears to have existed from remote times. The practice is known in Central Africa, in the West Indies, and in the islands of Polynesia. The remark that is usually made on the subject is the following :—

"The fermented juice of the banana is made at Cayenne and the Antilles into a palatable wine called 'Vino di banana.' A similar liquor is prepared in the Congo region, where it has the reputation of being a preventative of malaria."

One of the earliest accounts of the preparation of banana or plantain wine is given by Ligon in his *History of Barbados* (1657), p. 32 :—

"But the drinke of the plantine is farre beyond all these ; gathering them full ripe and in the height of their sweetnesse we pill off the skin and mash them in water well boyl'd and after we have let them stay there a night, we straine it and bottle it up, and in a week drink it ; and it is very strong and pleasant drinke, but it is to be drunk sparingly for it is much stronger than Sack, and is apt to mount up into the head."

A few years later Dampier (*Voyages*, I., p. 316) gives a somewhat similar account of banana wine in Jamaica :—

"When they make drink with them they take 10 or 12 ripe plantains and mash them well in a trough ; then they put two gallons of water among them ; and this in two hours' time will ferment and froth like wort. In four hours it is fit to drink ; and then they bottle it, and drink it as they have occasion ; but this will not keep above 24 or 30 hours. Those, therefore, that use this drink, brew it in this manner every morning. When I first went to Jamaica I could relish no other drink they had there. It drinks brisk and cool, and is very pleasant."

One sort of plantain is mentioned by Speke as yielding in Central Africa "a wine resembling hock in flavour."

On the other hand Schweinfurth found that "any fermented drink made from plantain to be almost unknown among the Monbuttos."

Mr. H. H. Johnson, C.B., in the neighbourhood of Kilima-njaro, speaks of Mandara's soldiers during an engagement quenching their thirst "with liberal draughts of banana beer which the women were constantly brewing."

Mr. Stanley (*Darkest Africa*, ii., p. 239) remarks that at Awamba :—

"Two large troughs—equal in size to small canoes—were stationed in the village, in which the natives pressed the ripe fruit and manufactured their wine."

Finally Dr. Parke in his *Personal Experiences*, p. 332, adds :—

"Nelson treated us to some *pombé* (banana wine) to-day ; it was really very good, although made from bananas which were not at all ripe. This beverage is prepared by cutting two or three bunches of ripe bananas into pieces of half an inch in length, adding two gallons of water, and leaving it to stand. On the third day it is really a delicious drink. At first it has a sweet tart taste, which after four or five days becomes very acid. In a day or two more it changes to a fluid having qualities very like those of vinegar ; quite as sour in taste and smell. If boiled down on the third day it makes a good syrup."

In Polynesia the banana drink made there is apparently not fermented but consists of fresh pulp made with bananas diluted with the milk of the cocoa-nut or water.

Loudon adds : "a drink like the best southern cider is made from the banana."

A proposal was made a short time ago to import bananas in pulp to Europe for the purpose of making wine from it.

Trade.

Fresh Bananas in the United States.—The following information, issued in 1889 by a large dealer in bananas at New York, is reproduced from the *Agricultural Record* of Trinidad, i., pp. 47, 48 :—

" Regarding bananas, good, large fruit and large bunches will always bring good prices in this market. Small bunches and small fruit never pay the shipper. March, April, May, June, and July, are the best months to ship bananas here. Extra fine large bunches in those months will bring $2 to $2 25 c. per bunch and ready sale, when small bunches will not sell for over 60 c. to 75 c. per bunch and a drug in the market at even those low prices.

" Bananas are brought to New York by the thousands of bunches very successfully, and the passage by steamer is from eight to nine days and oft times 10 days. Our market would take one million bunches of bananas a month at $2 to $2 25 c. per bunch (extra fine fruit) in the months mentioned above, and the banana trade is as yet only in its infancy. The demand is increasing each year.

" I imported 20 years ago 4,000 bunches bananas from Baracoa, it took 10 days to sell them. Ten years ago I imported a cargo of 10,000 bunches on the S.S. " Cleopatra," from Jamaica ; everybody said I was crazy ; it took four days to sell them. This year I have seen 14 steamers discharging cargoes in New York in one week, ranging from 10,000 to 16,000 bunches bananas each. The cargoes were sold out in four to five hours."

The latest information in regard to the trade in fresh bananas at New York is contained in the following note which appeared in *Garden and Forest*, May 9, 1894, p. 190 :—

" The demand for bananas is shown by the quick sale of 130,000 bunches in this city alone last week, at a wholesale price as high as $1 65 c. a bunch. The scarcity and high price of domestic and all other foreign fruits, excepting pineapples, help the sale of bananas at this season, and large orders are received here from the interior and from Canada."

Fresh Bananas in England.—Fresh bananas are regularly shipped to this country and the Continent from Madeira and the Canary Islands. The quantity received is not large. This may be accounted for by the fact that the fruit is not always of good quality, and consists for the most part of the produce of the dwarf banana (*Musa Cavendishii*). When well grown and allowed to get fully ripe this is, however, an excellent fruit. As seen in this country it is evidently gathered before it is fully grown, the pulp is dry and mealy, and there is little or no flavour. A few bunches of the best Jamaica and Fig bananas are occasionally received in this country, but on the whole the English have not shown a disposition to use bananas as a dessert fruit on anything like the scale seen in the temperate parts of the New World.

According to the *Gardeners' Chronicle*, 1886 [1], p. 498, "The exportation of bananas from Grand Canary and Teneriffe is reported

to be considerably on the increase, and it is expected that it will soon become one of the principal exports, as direct communication between Grand Canary and London is established. During 1885 from 40,000 to 50,000 bunches of this fruit were shipped to Europe, averaging 3*s.* per bunch, Grand Canary alone contributing between 25,000 and 30,000 clusters."

Musa Cavendishii, Lamb.
(From "Gardening Illustrated.")

The Canary banana, as it is called in Covent Garden, arrives in this country with each bunch packed separately in narrow tall baskets made from the split stems of the common reed *Arundo Donax*, specially grown for this and other purposes in moist places in the islands. The bunch of fruit stands on end in the basket, and is carefully and compactly packed with dry banana leaves to prevent injury. The base of the fruit stalk or peduncle usually projects beyond the sacking covering the mouth of the basket, and it affords a convenient handle for lifting and moving the package in transit.

Bananas usually sell in England during about eight to nine months in the year. They are not sought for during the months of June, July, and

August, as fresh fruit, especially strawberries, are then coming into the market. Recently Canary bananas fetched on an average 8*s*. per bunch. Some extra large bunches fetched as much as 15*s*., "and, in very exceptional cases, as much as 21*s*. to 23*s*. has been realised per bunch." One dealer in foreign fruit at Covent Garden has storage room for 2,000 to 3,000 bunches, and sales take place three times a week.

The returns for bananas, as distinct from other fresh fruit, are not given separately in the Customs' returns, hence it is impossible to form an accurate idea of the total imports into the United Kingdom.

The following information respecting fruit-growing in the West Indies and on the probability of shipping fresh fruit to this country is taken from a paper read before the Royal Colonial Institute by Mr. Morris on "Fruit as a factor in Colonial Commerce," February 8, 1887 :—

"A very interesting attempt was made last year to import fresh tropical fruit from British Guiana by Messrs. Scrutton & Sons, who had one of their steamers fitted with a cool chamber specially for the purpose. Bananas and many delicate fruits were received from the West Indies during the course of the Exhibition in excellent condition.

"The fruit trade in Jamaica is the means of circulating nearly 250,000*l*. annually amongst all classes of the community, and this large sum is immediately available, without the vexatious delays formerly experienced in establishing other and more permanent industries. Bananas, for instance, come into bearing, at the latest, in about 15 or 18 months from the time of planting, and as the return is usually from 10*l* to 20*l*. per acre, the planter is able, with a comparatively small capital, to establish his land in cocoa, coffee, nutmegs, limes, oranges, and cocoa-nuts, which, when the bananas are exhausted, will remain a permanent source of revenue. It is on this account that I look upon the fruit trade of the West Indian Islands, as indeed of many other small industries, as calculated in the aggregate to build up, little by little, an improved condition for the people of these islands."

Export of Fresh Plantains.—The chief trade with the United States and Canada is in bananas. So far, fresh plantains have been imported only to a small extent. Plantains have, however, been grown and exported to the Southern United States from British Honduras, Guatemala and the Mosquito Coast, and they are much appreciated as an article of food. They can be packed loosely instead of in bunches as in the case of bananas, and the money value on the cultivation is much larger than on bananas. For instance, as shown by Mr. Brigham, the return on plantains in Guatemala is at the rate of 144 dollars per acre, while the return on bananas is 106 dollars. Plantains to the value of 12,191 dollars were exported from British Honduras in 1892. The present Governor of British Honduras, Sir Alfred Moloney, K.C.M.G., evidently looks upon the plantain as likely to be in much greater demand than at present in the United States, if only to supply an acceptable food to the negroes in the South. He says "the plantain is a staple food over a large section of negro land in West Africa. The descendants of its interesting people to the north of the Gulf of Mexico represent a consuming power of nearly nine million people. . . . Our shipment to New Orleans rose from 50,000 plantains in 1879 to 1,580,200 in 1891."

The exports from Jamaica, Cuba, and other islands in the Carribean Sea are almost entirely bananas. Plantains are regarded locally as so

much more valuable for food purposes than bananas that they are comparatively scarce. There is no doubt they could be more largely grown if a demand arose for them. But the present situation is all in favour of exporting bananas only, and in keeping plantations as a staple food for the coloured population. It is quite possible that in a few years there will be a change. People in temperate countries who know little or nothing of the merits of the plantain are apt to regard it merely as an inferior banana. This is far from a due appreciation of its merits. In a cooked state, whether ripe or unripe, it is a wholesome and nutritious vegetable. It certainly will become in larger demand in the United States and Canada during the winter months ; and it is possible also it may come into use in Europe if once it had trial under suitable circumstances. The flavour of an unripe plantain roasted or boiled resembles that of a chestnut, but it is not then sweet ; when fully ripe it has the consistence of a pear with a sweet acidulous taste. It may then be eaten roasted or fried in fat like apple fritters. An important product of the plantain is plantain-meal. This is more fully dealt with later.

Guatemala.—The circumstances attending the cultivation and shipment of bananas and plantains to New Orleans and the Southern United States from Central America are very graphically described by Mr. William T. Brigham (*Guatemala*, pp. 351–354). This information applies also for the most part to the neighbouring countries of British Honduras and the Mosquito Coast. The comparison drawn by Mr. Brigham between the relative productiveness and value as between bananas and plantains is specially striking :—

"No export from Guatemala has increased more rapidly in value. The permanent establishment of lines of steamers between New Orleans and Livingstone, and the bounty offered by the Government, stimulated the planting of many small *fincas* along the shores and on the river-banks. Under contract with the steamship companies, the producer sells his bananas at 50 cents a bunch (of not less than eight hands) during five months of the year, and for 37½ cents the rest of the year. The cost of production may be placed at 12½ cents per bunch. All these prices are in United States silver currency. Plantains are sold at 25 cents a bunch of 25, sometimes commanding $1 25c. per 100. The profits of this business go, as usual, not to the producer, but to the middleman or the steamer companies. For example, a man raises 100 bunches of good fruit; the cost to him is $12 50c. delivered on board the steamer. He is paid in the best season $50 in silver, for which he can get $40 in American gold. The steamer people, after a voyage of four days, during which all their expenses are paid by the passenger list and the Government mail subsidies, sell the bananas on the wharf in New Orleans for $125 in gold or its equivalent, clearing $85 ; while the planter, for a year's labour put into the bananas, gets $30. I have put the price paid the planter at the highest, and the sales in New Orleans at the lowest. The loss is insignificant at these figures, and it is not uncommon for the profits of a single round trip of two weeks to exceed $40,000. Half this shared with the planter would make him rich.

"If the planting of bananas is to profit the grower he must raise enough, say 20,000 bunches a month, to freight his own steamer, and be independent of the present monopolies of the Italian fruiterers. The extent of this busines is seen in the fact that from Livingstone in 1883 were exported 29,699 bunches, and in 1884, 54,633, or nearly double the amount.

"Of all the varieties of the banana (and I have myself seen at least 200, including the seeding banana of Chittagong) only two or three are raised for exportation in Guatemala, and these are by no means the best; but as the steamer people will give no more for a choice variety there is no inducement to improve the stock. Both yellow and red varieties are grown, and the former sometimes have 250 bananas on a bunch, weighing unripe, 90 pounds. The plantain is yellow when ripe (I have never seen a red variety), and is much larger and more curved than a banana, while the bunches are looser and much smaller, seldom numbering more than 35 fruits. Some plantains attain a length of 15 inches, and some are quite palatable uncooked, but the usual way to eat them is either baked or fried. Few of our Northerners appreciate the wonderful nutritive qualities of the plantain, which in this respect surpasses the banana, and it may be authoritatively stated that 1,607 square feet of rich land will produce 4,000 pounds of nutritive substance from plantains, which will support 50 persons, while the same land planted with wheat will support but two.

"The comparative cost and profit of cultivating bananas and plantains may be thus stated :—

Cost.		Profit.	
		Bananas	Plantains.
	$		
Cost of one acre of land - - -	1.00	300 bunches of bananas at 50 cents, less cost.	15,000 fruits of plantains at $1.25 per 100, less cost.
Clearing and planting - - -	20.00		
Purchase of 430 stools - - -	2.50		
Care of plantation per acre to first crop - - - - - -	10.00		
Gathering and shipping crop - -	10.00		
Total- - - -	$43.50	$106.50	$144.00

"The second year the increase would be in favour of the plantain, and the product has reached more than 35,000 per acre. Of the fibre, no account has been taken, although this bids fair to become an important by-product. The plantain contains more fibre than the banana; the inner portions in both stems being much finer. At present the possible four pounds of fibre in each stem is wasted; and as the stems should be cut to the ground after the fruit is gathered, these large fibrous trunks are much in the way of cultivation. It will be remembered that the Manila hemp is the product of a species of banana (*Musa textilis*).

"Usually bananas or plantains are planted in a *cafétal* or in a cacao or orange orchard, to shade the young plants, and after three or four years are removed as the more permanent trees attain their growth."

Preserved Ripe Bananas.

For some years bananas have been preserved on a small scale in Jamaica, and it is hoped by this means to make use of small bunches of fruit not large enough to be shipped in a fresh state. Small bunches

are, as a rule, unsaleable, although the individual fruits may be as fine, if not finer, than in the large bunches. It has been already shown that while 2 to 3 dollars will be paid in New York for large bunches the small bunches will not sell for over 60 or 70 cents, and, as a broker has graphically remarked, "be a drug in the market even at these low prices."

If a good opening were established for well-preserved bananas, a very attractive and palatable food, capable of being kept for some time, would be available to the population of temperate climates. Ripe, or nearly ripe, bananas have sufficient sugar in them to enable them to be dried like figs. They cannot always be dried in the sun. The process is too tedious and the fruit often assumes a dark colour with a taste and smell suggesting acetic fermentation.

In Western India at Agási, north of Bassein, Nairne says, "They have a way of drying bananas, which if done scientifically and for export might probably make the fruit in that form as popular in England as dried figs."

A sample of preserved bananas or plantains prepared at Kurunegala, Ceylon, by Mr. Morris, the Assistant Government Agent in 1840, was presented in that year by Dr. Wallich to the Agri.-Hort. Society of India (*Trans.* VIII., pp. 58–59). The kind of plantain used was that known in Ceylon as "Suandelle." Dr. Wallich stated, "The plantains appear to me to be little inferior to figs, and I should think them as wholesome and nutritious." Attached to Dr. Wallich's letter (as published) is given an extract from Captain Colquhoun's paper read before the Society of Arts on specimens of dried plantains called *platano passado* from Mexico. "The object of Captain Colquhoun is to direct attention to the dried fruit of the plantain as an article of produce hitherto unknown in British Colonies and in European commerce which would probably obtain a considerable consumption in England, and also be very acceptable as a useful and agreeable article of food on long sea voyages."

Dr. Shier, of Demerara, is quoted in the "Catalogue of the Paris Exhibition of 1867," in regard to preserved bananas as follows :—

"*Ripe plantains and bananas.*—It was supposed by the Society of Arts (*Trans.*, vol. L., pt. i.) that the dried yellow plantain [or banana] might come into competition with figs, and the sample exhibited at the great London Exhibition of 1851, which had been prepared in Mexico many years before, proved the great superiority of the *platano passado* over figs in keeping properties and in immunity from insect ravages. In Mexico, the simple exposure of perfectly ripe plantains or bananas to the sun's rays is sufficient to prepare them for the market in an exportable form, as may be seen by the 'Method of Drying the Plantain,' described by Mr. Percy W. Doyle in a communication to the Earl of Malmesbury, a copy of which was transmitted to this Colony on 2nd August 1852 by Sir John Pakington. But whether from the greater moisture of this climate, or a greater proportion of nitrogenous elements in our plantains and bananas, it is found in practice that simple solar exposure is not adequate for the preparation of this dried fruit. There are three modes, however, by which the object can be attained :—1st, by exposing the fully ripe fruit to an atmosphere of sulphurous acid gas, previous to the drying process being commenced; 2nd, by a hasty boil of the fully ripe fruit in water containing sulphate of lime (hard water); and 3rd, by a similar parboil in syrup.

"By either of these processes the albumen and caseine of the fruit become sufficiently coagulated, and the tendency to fermentation and decay is arrested till the proper dryness is obtained. There is some nicety required in knowing the best degree of ripeness of the fruit. It should be full and beginning to turn yellow before the plantain tree is cut down and the bunch gathered. The fruit then should be kept either on the stalk or separated in a close dry place, as recommended in the Mexican plan, till the yellow of the rind has become black at the ends, with large spots over the surface, till on some of those black spots '*blue mould*' has begun to appear, and swarms of small grey flies hover over the heap, attracted, no doubt, by the saccharine odour, and till the fruit yields to a slight pressure of the finger and is somewhat supple in the hand. At this time, if some of the rind be removed, portions of the opaque yellow surface will appear as if melting. There should be no delay then in parboiling, or the fruit will be lost. If, on the other hand, the drying process is commenced too soon, a portion of the starch is still unconverted, and the dried fruit will be hard and want sweetness. This condition is easily discovered after the drying is completed, by the absence of a due amount of *shrinkage* in the fruit. To dry the fruit in the sunshine a bamboo frame as used in Mexico, or a net, or any other contrivance by which the sun and air can play on them, is suitable. They must, however, be removed to shelter on the approach of rain or evening dews. In rainy weather the heat of an oven is requisite, but the oven should be left open at the mouth, else the fruit will be baked instead of dried, and the heat should be comfortably bearable by the hand, else the grape sugar will be caramelized, and the core of the fruit blackened and rendered bitterish. Tight close packing in drums under considerable pressure, as with figs, would no doubt contribute materially to the preservation of dried ripe plantains and bananas."

Since Dr. Shier's time a great advance has been made in drying fruit. What are called "American" fruit-drying machines have been rendered so effective that little difficulty is experienced in drying the most succulent fruits in a few hours, and at the same time preserving all their fresh flavour, and also in many cases even the colour. The fumes of sulphurous acid, in no way injurious to the subsequent value of the preserved fruit for food purposes, are used to render some fruits like sliced apples of an attractive colour, and there is no doubt, although it does not appear to have been tried, a similar treatment would be of advantage if applied to the bananas. A dark colour would naturally give dried bananas an unattractive appearance, and prevent their extended use. In fruit-drying machines, properly worked, the danger can easily be obviated by keeping the temperature well below that necessary for the formation of caramel, and by the previous aid of sulphurous fumes the fruit might be produced of a pale buff colour, similar to that of figs.

It may be added that the comparative loss of weight by evaporation has been observed between apples and bananas, with the result that while apples yield only 12 per cent. of the original weight, bananas, with the skins removed, will give within a fraction of 25 per cent. of thoroughly desiccated fruit. Professor Church, with fruit grown at Kew, obtained 31·7 per cent. of dry matter from ripe bananas.

In 1881, when samples of dried ripe bananas were forwarded to this country by the late Mr. W. B. Espeut, F.L.S., of Jamaica, Messrs. Fortnum, Mason, & Co., stated, "we are afraid they are not suited to the

English taste. The dried banana is no novelty to us, as for several years past West India merchants have endeavoured to introduce it to the London market, but with doubtful success, as in no instance have we heard of their being imported by the same firm a second time." Messrs. Mart & Co., of Oxford Street, gave a somewhat similar opinion : "the samples are very good, but we do not think any large or even moderate trade would be done in them . . . about 25 years since some preserved spiced bananas, in sealed tins, were sent to us from Jamaica, and again some dried ones were sent from Ratatonga ; these were quite black. On another occasion some arrived in London, wrapped in Indian corn leaves ; they were in neat parcels of about $1\frac{1}{2}$ pounds weight each, but much darker than the present samples."

Again in 1888 a very attractive sample of preserved bananas was received at Kew from Mr. W. Fawcett, F.L.S., Director of the Botanical Department, Jamaica. In this sample the fruit was preserved whole, it was of good colour, and put up in a neat small box, exactly like the best qualities of figs. The report in this instance was, however, not very encouraging. In *Gall's Weekly News Letter* of August 9, 1890, the subject of exporting preserved bananas from Jamaica is revived. The new process of drying the surplus bananas, it says, "opens up a vista of future prosperity, and presents a pleasing picture of agricultural welfare before our eyes. Samples of dried bananas were submitted to the Royal Agricultural Society, and other samples have been sent to prominent fruit importers in England and Scotland, and the reports have been of an exceedingly satisfactory character."

One correspondent wrote :—"I submitted the sample to Mr. Jamieson, one of the largest fruit importers in Edinburgh. By a strange coincidence he had been shown a sample of the same article from Madeira on the previous day. The sample he thought a little better than yours, not being so highly dried, and retaining more of the real flavour of the fresh fruit. He is of opinion that if the drying process could be brought to greater perfection, and as much as possible of the fruity flavour preserved, they would take the place of every other dried fruit, and there would be a large demand for them. He says people are getting tired of figs, dates, &c., and would eagerly turn to bananas for a change."

In Venezuela the best banana for preserving is the *cambur morado* or red banana, because, says Diaz, "it is larger and it has a better flavour." In the dry climate of the lower hills the process can be successfully carried on by simple exposure to the sun. The bananas must be quite ripe, they are stripped of shell and fibre and placed on a cloth in the sun, being turned every two hours without crushing them like the plantain ; at night they are gathered in and the next day put out again, and so on until they are perfectly preserved. "If they have five or six sunny days in succession they are good in that time."

It would appear that the United States and Canada are likely to afford as favourable a market for preserved bananas as for the fresh fruit. Most of the preserved bananas hitherto prepared in the West Indies have gone to other countries. As showing the result of an interesting experiment tried with preserved bananas in Trinidad the following account of fruit, shipped to Canada, is taken from the *Agricultural Record* of Trinidad, 1891, pp. 143–144.

Convict Depôt, Chaguanas,
April 9, 1891.

DEAR SIR,

Messrs. Gordon, Grant, & Co. have kindly given the result, in an account sale, of a trial shipment of preserved ripe bananas. I venture to think this experiment will prove to be of important interest to banana growers, especially to those who have the right kind for drying, namely, the Gros Michel, known also as the Jamaica or Martinique banana. Drying the bananas opens up a way of utilising the fruit that no other means offers. It overcomes the difficulty of bad roads, remote districts, and other drawbacks which the planter has to face in getting his bananas to market. It also does away with the risks of handling and of the sea voyage.

Dealing with the first item in the account, namely, 97 boxes, this number represents the result of drying six bunches, weighing on an average 52 lbs. per ripe bunch. A loss of one third takes place in the peeling and drying process. The 97 boxes contained one pound of dried fruit each and sold for $19 40c. or 20c. per lb. box, or, after deducting freight charges, $15 47c., a fraction under 16c. per lb.

A bunch weighing 52 lbs., less one-third in drying, gave 17 lbs. of dried fruit and sold at 16c. per lb. This is at the rate of $2 72c. per bunch. A further charge of 53c. must be considered in producing the bunch. This would cover purchase of land, clearing woods, draining, planting, weeding, cutting, drying, fuel, boxes, and packing. I have not included cost of drier, as that would be but a fraction on each bunch dried. Now after deducting the above we have a clear profit for the grower of $2 19c. (about 8*s*.) for every bunch of fruit produced.

This fine price has, I think, rarely been equalled in Trinidad for bananas and should encourage growers of this fruit to enter fully into the matter and improve upon my experiment. Not to do so would be to confirm his Excellency the Governor's words in the opening speech at our late exhibition "that the want of interest in a fruit trade was suicidal."

I do not desire to set up as a teacher, but facts and figures speak for themselves. The account shown is not an approximate one, but the money has been received, and the Canadians are asking for more at the same price. An order is now on hand for 2 cwt. for London at 6*d*. per lb. in bulk, the consignee doing the retail packing and advertising. As the fruit is something new it is being sought after, and all that can be dried is being profitably disposed of. I may add that the fruit-drier does its work well, turning out the fruit in an uniform colour. Attention must be paid to this and also that fruit as nearly as possible of one size only be dried, as this facilitates packing. Small ones can be used for stock, &c. ; 12 good sized fruits weigh one pound.

Gros Michel bananas dry best and give the best result. Governor bananas take second place ; the other varieties are not suitable. I state this from experiments with them all.

I trust in a measure the foregoing will aid to dispel the doubts and anxieties frequently expressed as to a profitable means of dealing with our fruit, especially bananas, for they are absolutely indispensable in growing young cocoa, for shade purposes. To those not well posted in the subsidiary industries and who are seeking information, that there is interest being taken in the matter is evident, for if only one line be mentioned upwards of 100,000 banana plants have been distributed in Trinidad and Tobago from the depôt during the past two

years, and as many more can be had if required. The purchasers of these plants are principally large planters, and this shows that there is money in bananas.

I recommend with confidence to the purchasers of these plants and to others interested, the advantages of a dried fruit trade. I do so from the facts I have learnt in the experiments made in aid of the fruit trade.

C. W. MEADEN.

Mr. C. W. Meaden adds that drying ripe bananas in the open air has proved a failure. This, however, has been remedied by the use of a hot air fruit-drier known as the "Etna Pneumatic Drier." The fruit in this "can be dried within 24 hours at a temperature from 130° to 160° F. A higher temperature than this is undesirable as the fruit hardens. The drying is done in the daytime and the fire put out at night. Any kind of fuel answers for firing, from patent fuel to cocoa-nut wood chips. The fruit should be as large as possible and quite ripe; the skin to be removed and the fruit lightly scraped. Whilst in the drier the fruit is to be turned twice or three times carefully to ensure even drying."

Preserved bananas from Fiji have recently been sold retail in London at 7*d.* per pound. To ensure a large demand for the fruit in a preserved state it must compete successfully with figs, dates, and raisins, both as regards quality and cheapness.

Preserved bananas are represented in the Kew Museum from Mr. Espeut, Jamaica, 1881, dried whole. Also from British Guiana, Col.-Ind. Exhibition, 1886. "Cannore figs" from Siam, shown at the Health Exhibition, 1884. "Dried bananas" from the Straits Settlements, 1886, neatly put up in a soft packing of dried banana leaves. A torpedo-shaped package tightly tied round with banana cord containing dried bananas received from Sir Ferd. von Mueller from Queensland.

PLANTAIN MEAL.

A good deal of interest has been taken lately in the production of plantain meal for food purposes in temperate countries. This in some measure is due to the frequent mention made of it in Mr. Stanley's work (*In Darkest Africa*) giving an account of the Emin Pacha Relief Expedition. But for the plantain, either in a fresh state or made into meal, this expedition would probably never have accomplished its task

For instance near the Amiri Falls (Vol. I., p. 450) "the foragers returned, often in couples with an immense bunch of plantains between them . . The more provident, however, bore larger quantities of the fruit, peeled and sliced, ready for drying, thus avoiding the superfluous stalk and skin . . The fruit when dry could be converted into cakes or palatable plantain porridge or a morning's draught of plantain gruel. Many of the finest specimens were reserved to ripen to make a sweet pudding, or a sweet brew, or for sauce for the porridge."

When between the Albert Edward Nyanza and the Albert Nyanza (Vol. II., pp. 239-240):—"For the first time we discovered that the Awamba, whose territory we were now in, understood the art of drying bananas over wooden gratings for the purpose of making flour. We had often wondered, during our life in the forest region, that the

natives did not appear to have discovered what invaluable, nourishing, and easily digestible food they possessed in the plantain and banana. All banana lands—Cuba, Brazil, West Indies—seem to me to have been specially remiss on this point. If only the virtues of the flour were publicly known it is not to be doubted but it would be largely consumed in Europe. For infants, persons of delicate digestion, dyspeptics, and those suffering from temporary derangements of the stomach, the flour, properly prepared, would be of universal demand. During my two attacks of gastritis, a light gruel of this, mixed with milk, was the only matter that could be digested."

Dr. Parke, surgeon to the expedition, also speaks (*Personal Experiences in Equatorial Africa*, p. 322) of the use of banana or plantain flour :—

"We found a little porridge of scalded banana flour, which had been just freshly made ; and a few leathern belts, which is the only native article of apparel. The discovery of this sample of porridge here struck me as very peculiar ; the first place where we had seen bananas dried and pounded into flour was at Ugarrowwa's camp ; even the Zanzibaris, and the other natives whom we have met on our line of progress, had not known this method of preparing bananas for food till they saw it used by us. So it is evident that the few natives with whom we had become intimate on our way had returned to their villages and told their neighbours what they had seen us do.

"Ever since we learned this method of preparing our bananas we have been able to diminish our risk of starvation very considerably. We can make enough flour in one day for several days' rations ; and the weight is so much less than that of the corresponding quantity of the green bananas, that men can carry a considerable number of days' rations with them, in addition to their other loads, whereas they could not manage more than a couple of days' supply of the green bananas. The banana flour is most nutritious and very sustaining."

It is generally recommended that to make the best banana meal the fruit should be in an unripe condition.

The changes that take place in the banana fruit during the successive stages of its growth and ripening are described by Dr. Warden in the *Dict. Econ. Prod. of India*, Vol. V., p. 301 :—

"The composition of the banana at different stages of maturity has been investigated by L. Ricciardi. The green fruit contains over 12 per cent. of starch, which disappears as the fruit ripens. It contains 6·53 of tannin and the ripe only ·34 per cent., so that as the fruit ripens this principle disappears, and this is also the case with the other organic acids which are present. The sugar in the fruit which ripens on the tree is almost entirely cane sugar, but in the fruit cut and ripened by exposure to air the invert-sugar reaches about 80 per cent. of the total, while the cane sugar is reduced to about 20 per cent., calculated upon the sugar present. Proteid substances (albuminoids) are present in the green fruit to 3·04 per cent., and in the ripe to 4·92 per cent. The green fruit yields 1·04, and the ripe ·95 per cent. of ash, which contains 23·18 per cent. of phosphoric anhydride, and 45·23 per cent. of potash."

The use of plantain-meal as an article of food is doubtless of great antiquity. It is frequently mentioned by old authors. Rumph records that in the Malay archipelago "man begins life with plantains" as the meal is used for making pap for new born infants.

In the *Dict. Econ. Prod. of India*, Vol. V., p. 300, the same point is more fully stated :—

"It is interesting to notice that the large crop of food produced by bananas and plantains may be preserved for an indefinite period either by drying the fruit or by preparing meal from it. Both of these processes, which have long been known and carried out in the West Indies and South America, are also carried out in India, though to a much smaller extent. Linschoten notices the practice as common in the sixteenth century, writing,—'these grow much in Cananor, in the coast of Malabar, and are by the Portingales called figges of Cananor ; and by reason of the greater quantities thereof are dried, the shells being taken off, and so being dried are carried over all India to be sold.' When the nearly ripe fruit is cut into slices and dried in the sun a certain part of the sugar contained in the fruit crystallizes on the surface and acts as a preservative. The slices thus prepared, if made from the finer varieties, make an excellent dessert preserve, and if from the coarser may be used for cooking in the ordinary way. They keep well if carefully packed when dry, and ought to form a valuable anti-scorbutic for long voyages. The fruit may also be similarly preserved whole by stripping off the skin and drying it in the sun. Plantain meal is prepared by stripping off the husk, slicing the core, drying it in the sun, and when thoroughly dry reducing it to a powder, and finally sifting. It is calculated that the fresh core will yield 40 per cent. of the meal, and that an acre of average quality will yield over a ton."

A good account of plantain meal and its value for food purposes was published by Professor Johnston in the *Transactions of the Highland Society*, No. 20. This was reproduced in the *Barbados Agricultural Reporter*, August 8th, 1848.

The inquiry was started by the receipt of a sample of plantain meal sent to Scotland from Surinam or Dutch Guiana. It is remarkable that after an interval of nearly 50 years the starting of a factory for the manufacture of plantain meal in the same Colony should once more bring the subject into notice.

Professor Johnston says : "Plantain meal is of a slightly brownish colour, and has an agreeable odour, which becomes more perceptible when warm water is poured upon it, and has a considerable resemblance to that of orris root.

"When mixed with cold water, it forms a feebly tenacious dough, more adhesive than that of oatmeal, but much less so than that of wheaten flour. When baked on a hot plate, this dough forms a cake which is agreeable to the sense of smell, and is by no means unpleasant to the taste. . . . . .

"When boiling water is poured over the meal it is changed into a transparent jelly, having an agreeable taste and smell. If it be boiled with water it forms a thick gelatinous mass, very much like boiled sago in colour, but possessing a peculiar pleasant odour."

In the plantain "while green, the heart is white and insipid ; the starch predominates, and it scarcely contains any sugar. In this state it is roasted in the ashes, and at table takes the place of bread, potatoes, maize, and other farinaceous food. In South America they are dried entire in ovens, and become hard, brittle, and translucid like horn. Under the name of "fifi' they are, in this state, taken as travelling stores in sea voyages and long journeys by land."

The starch of the arrow-root, cassava, and of the ordinary potato is easily extracted, but, according to Dr. Shier, the starch from the plantain (in the unripe state) cannot be extracted in a perfectly white condition, in consequence of being associated with a colouring matter from which it is almost impossible to separate it. This colouring matter resists the action of the most powerful bleaching re-agents.

In 1890 analyses of the unripe banana and plantain fruit were published by Messrs. Harrison and Jenman (*Report on Agriculture*, British Guiana, p. 59) :—

"COMPOSITION of a SAMPLE of BANANAS (unripe).

	Dried.	Fresh.
Water	5·75	75·11
Oil or fat	·69	·18
Sucrose	None.	—
Glucose	1·75	·29
Starch	42·11	11·11
*Albuminoids	5·13	1·35
Gums, &c.	1·88	·36
Digestible fibre	36·87	10·07
Woody fibre	2·52	·66
Ash (mineral matter)	3·30	·87
	100·00	100·00

* Containing nitrogen, dried ·84, fresh ·22.

"Though the food elements in the banana vary from those of the plantain, the sum total of them is much about the same. The plantain is decidedly richer in starch and glucose, while the banana excels in albuminoids and digestible fibre. The advantage in value is with the plantain.

"The following analyses of the common plantain, fresh and dried respectively, are closely representative of the character of all varieties. Plantains are essentially a starchy food, deficient in albuminoids and fats :—

"COMPOSITION of SAMPLE of COMMON PLANTAINS.

"Fleshy matter or pulp, 64·5 per cent.; skin, 35·5 per cent.

	Fresh Pulp.	Flour from Dried Pulp.
Water	62·86	11·80
Fats	·44	1·05
*Albuminoids	1·58	3·75
Glucose	2·25	5·34
Starch	22·16	52·64
Tannin, gum, &c.	·50	1·20
Digestible fibre	9·01	21·37
Indigestible fibre	·40	·95
Ash (mineral matters)	·80	1·90
	100·00	100·00

* Containing nitrogen, fresh pulp ·25, flour from dried pulp, ·60."

A valuable paper on the chemistry of the banana was published by the late M. B. Corenwinder in *Annales Agronomiques*, ii. (1876), pp. 429–445. His main results were obtained from a bunch of 107 fruits sent to him from Brazil in August 1875. The bunch was a month in transit to Lille. He found 34 per cent. of peel and 66 per cent. of pulp. His best fruits, while sound, gave 15·9 per cent. of sucrose and 5·9 per cent. of glucose. His worst gave 2·84 per cent. of sucrose and 11·84 per cent. of glucose.

Corenwinder gives the following complete analysis of the pulp (p. 436) :—

Composition of fresh Brazilian Banana (pulp only).

Water	72·46
Sugar (sucrose)	15·90
Sugar (glucose)	5·90
Cellulose	·38
*Albuminoids	2·13
Pectose	1·25
Oil, &c.	·95
Ash	1·03
	100·00

The composition of the ash (from the pulp) is given by Corenwinder. In the opinion of Professor Church, there is a possible mistake here in regard to the magnesium carbonate present.

Mineral Composition of the Ash from the Pulp of the Brazilian Banana.

Potassium sulphate	3·61
Potassium chloride	14·34
Magnesium phosphate	2·24
Potassium phosphate	27·12
Potassium carbonate	41·66
Magnesium carbonate	6 54?
Calcium carbonate	1·17
Ferric oxide	0·36
Silica	2·96
	100·00

In the South Kensington Museum Handbook on "Food" (reprint of 1893, p. 135) Professor Church, F.R.S., gives an analysis of fresh-peeled bananas (apparently nearly, if not quite, ripe). This affords information on a point not already discussed. The bananas were those usually sold in shops in this country, and it is not improbable they were Canary bananas yielded by *Musa Cavendishii*.

* Containing nitrogen ·34.

"Fresh-peeled bananas contain :—

——	In 100 parts.	In 1 lb.	
		oz.	grains.
Water - - - - - - - -	73·9	11	361
Albuminoids, &c. - - - - -	1·7	0	119
Sugar and pectose - - - - -	22·8	3	283
Fat - - - - - - - - -	0·6	0	42
Cellulose - - - - - - -	0·2	0	14
Mineral Matter - - - - - -	0·8	0	56

The nutrient-ratio is here 1 : 14 ; the nutrient-value is 24."

The " nutrient-ratio " amongst the nutrients of daily food is that between the albuminoids or "flesh-formers," and the carbohydrates plus the fat reckoned as starch, or "heat-givers." In the standard dietary adopted it is 1 : $4\frac{3}{4}$.

For the sake of making a rough comparison between various foods, it is a convenient plan to add together the per-centages of albuminoids, starch, dextrin, and sugar, and the starch equivalent of any fat present. The sum of these constituents is called the " nutrient-value ; " this value is that of 100 parts.

A further sample of ripe bananas (a variety of *M. sapientum*) grown in the Palm House at Kew was submitted to Professor Church in May last. The results of his analysis are as follows :—

" Water in pulp - - - - - - - -	68·3	per cent.
Dry matter in ditto - - - - - - -	31·7	„
Albuminoids, calculated from total nitrogen in pulp.	1·515	„
True albuminoids in ditto by phenol method -	1·03	„

"The latter figures seem to show that one-third of the nitrogen in the just-ripe pulp exists in non-albuminoid forms."

The most recent analyses of meals are those lately made for Kew by Professor Church, of a sample received through Messrs. Lee, Crerar, & Co. from Jamaica, and called " banana " meal, although it is quite possible it may have been prepared from unripe plantains. The other samples were from Surinam. The latter were particularly stated to be derived from the fruit of the banana (*Musa sapientum*).

Professor Church's analyses of these samples, with explanatory notes, are given below :—

Professor A. H. CHURCH, F.R.S., to ROYAL GARDENS, KEW.

Shelsley, Kew Gardens,
February 16, 1893.

DEAR MR. MORRIS,

I HAVE arranged in the table which follows, the results of my analyses of some of the banana meals which you handed to me for examination. The Jamaica sample is designated by the letter A. ; the Surinam sample of the meal made from the interior of the fruit of *Musa sapientum* by the letter B. ; and meal from the peels of the same fruit by C.

PER-CENTAGE COMPOSITION of BANANA MEALS.

	A. Jamaica.	B. Surinam.	C. Surinam.
Water	15·5	14·3	13·1
Albuminoids (true)	2·5	2·3	3·3
Starch, sugar, gum, &c.	77·7	79·5	58·7
Oil	1·0	·7	5·5
Fibre	·7	·9	8·7
Ash	2·6	2·3	10·7
Nutrient ratio	1:32	1:35	1:22
Nutrient value	82	83	74

It is noticeable how widely the nutrient ratio (or proportion of albuminoids to starch plus the starch-equivalent of the oil) diverges in all these meals from the ratio of a perfect food, which should show the proportion of about one to five. In the analyses by Mr. L. E. Asser the above divergence seems less marked, for he has calculated the whole of the nitrogen present as if it existed in the albuminoid form. I find that this is far from being the case. In his Surinam sample 2 (B. above) 71 per cent. only of the nitrogen present is albuminoid; in his sample 5, made from the peels, 77 per cent. In other respects my results and his agree well.

I would further remark that sample A. (from Jamaica) was probably made from fruits still more unripe than those which were used in the preparation of B. and C. For in this meal no more than 56 per cent. of the total nitrogen exists in the albuminoid form, the remaining 44 per cent. being present in the less highly elaborated state of amides, &c., the food value of which is either *nil* or very slight.

In all the above samples starch is more abundant than sugar; the proportion of the latter increases as the fruit ripens.

The constituent set down as "oil" in the table of analyses is the ether-extract of the meals. In the case of C, the meal prepared from the peels, it consists partly of wax and colouring matter.

In the ash of the meal prepared from peels a notable quantity of manganese was found. Traces of copper occurred in all the samples.

Yours truly,
(Signed) A. H. CHURCH.

Samples of the unripe fruits of the plantain, dried whole without the peel and slightly scraped, are in the Kew Museum from British Guiana. There are also dried plantains in thin transverse slices from Bombay and British Guiana. Plantain and banana meals are shown from Madras of a dark colour; from Fiji of a light chocolate colour; from Jamaica both of a dark and light colour. The latter sent by Mr. Chitty is of excellent texture and quality. It has been in the Museum nearly 35 years.

British Guiana.

The following interesting suggestions respecting the preparation of plantain meal are taken from a report prepared in 1847 by Dr. Shier on the Starch-producing Plants of British Guiana. They appeared in the "Catalogue of Contributions transmitted from British Guiana to the Paris Universal Exhibition of 1867," pp. xlviii–li. :—

"The plantain is sometimes so abundant and cheap that it might, if cut and dried in its green state, be exported with advantage. It is in this unripe state that it is so largely used by the peasantry of this Colony as an article of food. It has always been believed to be highly nutritive; but I have not found in any sample of the dried plantain which I have analysed a larger amount than ·81 per cent of nitrogen, which corresponds with about 5½ per cent. of proteine compounds. When dried, and reduced to the state of meal, it cannot, like wheat flour, be manufactured into maccaroni or vermicelli, or, at least, the maccaroni made from it falls to powder when put into hot water. Plantain meal is prepared by stripping off the husk of the plantain, slicing the core, and drying it in the sun. When thoroughly dry it is powdered and sifted. It is known among the Creoles of the Colony under the name of *conquintay*. It has a fragrant odour, acquired in drying, somewhat resembling fresh hay or tea. It is largely employed as the food of infants and invalids. In respect to nutritiveness, it deserves a preference over all the pure starches on account of the proteine compounds it contains. The plantain meal would probably be best and freshest were the sliced and dried plantain cores exported, leaving the grinding and sifting to be done in Europe. The flavour of the meal depends a good deal on the rapidity with which the slices are dried, hence the operation is only fitted for dry weather, unless, indeed, when there was occasion for it, recourse were had to a kiln or stove. Above all, the plantain must not be allowed to approach too closely to yellowness or ripeness, otherwise it becomes impossible to dry it. The colour of the meal is injured when steel knives are used in husking or slicing, but silver or nickel blades do not injure the colour. Full-sized and well-filled bunches give 60 per cent. of core to 40 of husk and top-stem; but in general it would be found that the core did not much exceed 50 per cent., and the fresh core will yield 40 per cent. of dry meal, so that from 20 to 25 per cent. of meal is obtained from the plantain, or 5 lbs. from an average bunch of 25 lbs., and an acre of plantain walk of average quality, producing during the year 450 such bunches, would yield a ton and 10 lbs. of meal. Even supposing the meal not to command over half the price of arrowroot, it would still form an excellent outlet for plantains whenever, from any cause, the price in the Colony sank unusually low."

United States.

During the year 1892 it is stated that nearly 13 million bunches of ripe bananas were imported into the United States. Each bunch usually consists of 80 to 200 bananas, and weighs from 30 to 90 pounds. Bananas were received principally at New Orleans, New York, Philadelphia, and Boston, each of which imported not less than two million bunches. It is said that these enormous figures are likely to be exceeded in later years. The banana is grown for export chiefly at Jamaica, Cuba, Nicaragua, United States of Colombia, Honduras, and Costa Rica. The value of fruit exported from Jamaica in 1891 (chiefly to the United States) amounted to 531,726*l*.

"The great advantage," according to a New York correspondent, of the application of the desiccating process to bananas would be that it would enable us to turn to account a quantity of raw material which now goes to waste. There is practically no limit to the amount of bananas which we could get from the islands if we could use them. They are shipped green and ripen on the voyage. When they arrive here it is calculated that they will be fit for table use. But they are very perishable property. If they are not consumed within a week after their arrival vast quantities rot and are thrown away. Strings of banana waggons perambulate the city seeking purchasers at nominal prices, because if immediate sales cannot be effected the contents of the waggons will be a total loss.

"If we had a desiccating plant that could convert the fruit into dried fruit or flour we could largely increase our importations and turn out a product which would command a sale all over the coast and in the East."

The manufacture of banana meal in the United States would have a certain amount of protection from outside competition, for while there is no duty, or a small one, on the fresh fruit, there is a duty of 20 per cent. on banana meal as a manufactured product.

JAMAICA.

The enormous production of bananas in Jamaica has already been noticed. In this island bunches of a certain size only possess a marketable value. All others are practically useless except for consumption locally, and already the supply for this is greatly in excess of the demand. As Jamaica is at present the largest producer of bananas for export, it follows that the preparation of banana meal would have a wider scope in this island than probably anywhere else. A sample of what was called banana flour prepared in Jamaica was communicated to Kew in 1892. This was analysed by Professor Church, F.R.S., with the result already given.

Some years ago plantain meal—as distinct from banana meal—was in use at the Public Hospital in Kingston, and was considered a wholesome and nutritious food. It formed an excellent diet for patients suffering from diarrhœa, dysentery, and allied ailments. This is confirmed by experience in India. "Flour made out of green plantain dried in the sun is used in the form of *chappatis* (unleavened cakes) in certain parts of Tirhoot in cases of dyspepsia with troublesome flatulence and acidity. I have known," says a medical officer, "one case in which it agreed remarkably well whenever a diet of plain sago and water brought on a severe attack of colic. The *chappatis* are taken dry with a little salt." There is always present in plantain meal a certain small percentage of tannin.

In a report on the Exhibits sent from Jamaica to the Chicago Exhibition, 1893, Colonel Ward, C.M.G., the Commissioner, makes the following remarks on the subject of banana meal and preserved bananas:—

"The banana meal engaged the careful attention of several of the leading grocers in Chicago and elsewhere. One large house in Chicago, Sprague, Warner, & Co., after testing samples of this meal was so pleased with the result that it offered to undertake to introduce it as a food for infants and invalids, provided the producers would guarantee to supply the necessary amount to advertise it extensively throughout the United States. Messrs. Sprague, Warner, & Co. estimated that a sum of

not less than $25,000 would be necessary to launch this new product on the American market, and unless this sum were forthcoming, they did not see their way to dealing with it on the ground that no sales in any quantity could be expected. This proposal was in due course submitted to the exhibitors, whose meal had been experimented upon; but unfortunately those gentlemen were unable at the time to adopt the course proposed, and the matter is still in abeyance. I am strongly of opinion that with a judicious outlay of capital, and with a reasonable certainty that no sudden changes will be made in tariff regulations, there is a market open for banana meal in the United States.

"I have seen ripe bananas offered for sale in the streets of Chicago, at almost the same price as they are in Kingston, though of course the quality is distinctly inferior."

Trinidad.

The following account of the preparation of plantain meal at the convict farm, Trinidad, by Mr. C. W. Meaden is quoted in the Bulletin of the Botanical Department, Jamaica, xxvi., p. 5. The meal was prepared from a plantain known in Trinidad as the "Moko." This is usually grown as a shade for young cacao trees. It appears, otherwise, to have little value. Mr. Hart refers to it in his report for the year 1887, p. 18, as "the useless Moko or Jumbi plantain or Fig." It is somewhat remarkable that the meal prepared from this despised but very widely distributed plant should prove of so good a quality.

"No banana gives such an excellent meal as the 'Moko,' or so agreeable in flavour and taste. The preparation of the meal is as follows:— The green Moko was skinned, sliced thin, and dried in the fruit drier; then ground fine in an ordinary corn mill, and afterwards sifted through a muslin sieve; this latter removes any fibre, and leaves a delicate fine meal. The slices dry in two hours. A 15 lb. bunch will yield 3 lbs. of prepared meal, which at 6*d.* per pound is 1*s.* 6*d.* per bunch. Two women could prepare 56 lbs. of meal per day. The cost of production, packing, &c., has to be considered, but the price estimated to be obtained in this way for the fruit must be considered a satisfactory one; at least it is better than that now obtained, which may be said to be nil."

In a letter to the *Port of Spain Gazette*, dated 21st October, 1892, Mr. Meaden gives the following further particulars:—

"It is proved by analysis that bananas contain 76 per cent. of starch, and it is certain that an article containing this quantity must have a profitable market value. Sliced bananas at a temperature of 130 per cent. dry in two hours and could be packed for shipment from the green bunch well within the day's work. A drying apparatus for this purpose can be most cheaply and effectually built by a local workman, and it would also be useful on the estate for all drying purposes."

Dutch Guiana or Surinam.

From information communicated to Kew by Mr. Louis Asser, of the Hague, Holland, the preparation of dried bananas and of banana and plantain meal is proposed to be taken up on a large scale in Dutch Guiana. Already various preparations from this part of the world have been shown at the International Exhibition held at Brussels by an association called the "Stanley Syndicate." Preference appears to be given in this case to the banana on account of its lesser value locally, and

because it is believed in Surinam to be a stronger plant "and less liable to be injured by rain and storms which are particularly severe on the plantain." The meal was obtained by slicing the fruit by machinery into thin pieces and drying them in a fruit-drying apparatus. The dried slices were then ground into a meal in a mill and carefully sifted. The analyses of various meals made in Surinam show that the meal prepared from both plantain and banana has almost the same composition. A set of preparations has been forwarded to Kew by Mr. Asser, consisting of the following articles. The list is given in full as it shows the numerous commercial uses to which the fruits of the plantain and banana may be put :—

(1) Dried slices of the entire fruit (pulp and peel) in the starchy state suitable for the preparation of alcohol or for making into a nourishing bread ; (2) meal in a starchy state from the pulp only for making into a superior kind of bread or porridge ; (3) flakes and meal in a dextrinous state for use in breweries or for making into nourishing soups, puddings, &c. These flakes are of a rich brown colour, and retain the banana flavour. Another preparation, very similar but sweet, is intended for making into wholesome confections, cakes, biscuits, &c.; (5) dried peel and coarse meal prepared from it intended as a feeding material for cattle and pigs ; (6) banana marmalade ; (7) dried bananas entire and without peel put up like dried figs in boxes ; (8) raw alcohol prepared from fresh bananas and also from dried banana meal ; (9) sugary syrup of bananas "of agreeable odour and flavour," suitable for confectionery purposes, for preparation of liqueurs and for sweetening champagne ; (10) banana meal for the manufacture of glucose and a sample of syrup and sugar prepared from it ; (12) fibre of banana and plantain prepared from the discarded stems after fruiting, and intended for the manufacture of paper and cordage.

The use of banana meal in the preparation of alcohol is no doubt borrowed from the example at St. Michael's in the Azores, where since the failure of the orange cultivation sweet potatoes are largely grown, cut into thin slices, ground into meal, and then converted into alcohol. During the year 1884 there was exported from the Azores alcohol of the value of 40,588*l*., made entirely in this manner from the sweet potato.

It is estimated by Mr. Asser that the cost of banana cultivation in Surinam will be at the rate of 2*l*. 10*s*. for every ton of meal. The cost of gathering the crop and making the meal will be at the rate of 18*s*. to 20*s*. per ton ; while the cost of freight to Europe will be about 25*s*. per ton. The estimated net cost of delivery of banana meal in Europe is therefore placed at 4l. 15*s*. per ton. Considering the market value of the banana meal to be at the same rate as Indian wheat, viz., from 5*l*. 10*s*. to 6*l*. 10*s*. per ton, Mr. Asser claims there would be a margin of profit on banana meal equal to about 15 per cent. on the capital invested.

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