

EAST AFR. PROT

697

C. I. O.

697

REC'D

JAN 5 1913

Colonial Office

1913

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Paper producing plant

Copy taken by enclosing covers with view of  
possibility of cultivation of *Adiantum* species

letter also sent to Gambia, Gambia, Sierra Leone,  
Liberia, Mauritania, Senegal and Guinea.

to be done

200

Next subsequent Page

53431/8 MP



COPY.

697  
REC'D  
RECEIVED JAN 13

Kew,

December 31st, 1912.

Dear Mr. Harcourt,

Hedychium coronarium.

(1) the stems are sent home dry, after having been passed through steam rollers to extract the moisture. It has been found that this dried material is quite as useful for paper-making as the fresh green stems; the drawback in this case is that the material to be handled is very bulky.

Or (2) the stems may be pulped on the spot and sent over as "half-stuff", as is done with wood pulp, to be finally worked up in England; this would probably be more economical than the first method owing to the saving in carriage where, as is usually done, consignments are calculated in tons of 50 cubic feet, not by actual weight.

Or (3), most economical plan of all, a paper-mill may be established on the spot in any of the African Colonies enumerated in your letter where the plant can be induced to grow on an economic scale; this has been done in the State of Parana, Brazil, where the plant has spread so widely.

In any case the need to consult a firm such as Messrs. Clayton Beadle and Stevens will only arise when it has been demonstrated that the plant will grow in the places to which its introduction is now proposed

proposed. This it ought to be realised at the outset will be a matter of time. We cannot anticipate that supplies sufficient for trade purposes will be available in less than five years from now.

2. Kew will gladly arrange for the introduction of the plant both to East and to West Africa. The rootstocks would probably die if they got too dry in travelling. The plant can be reproduced from seed.

3. If entrusted with the duty we could arrange to obtain a supply of rootstocks for West Africa from the Royal Botanic Gardens at Calcutta and Peradeniya. It is certain that in neither place could large supplies be obtained, but both institutions would probably be willing to arrange to secure a supply of rootstocks from suitable sources.

In north-western India, where I am personally familiar with the plant, it is common in the bottoms of steamy valleys of the Eastern Himalaya and of the mountain ranges between the Brahmaputra and the Irrawaddy up to 3000 feet. In Ceylon it is described as being equally plentiful, in similar places, up to 4000 feet.

4. A warm subtropical or quite tropical climate is essential.

5. It will not stand drought.

6. It must have good soil.

One or two points have to be taken into consideration. We know that Hedychium coronarium will grow in West Africa and that it has already got naturalised.

naturalised, no doubt by introduction from Brazil as an accident of the trade in slaves, to the Gabon and Spanish Guinea. But we do not know if in West Africa as in Brazil it spontaneously spreads so as to cover considerable areas. On its capacity to do this will, I think, to a very large extent depend the chance of successful introduction of the Hedychium on a commercial scale. There would seem to be no reason why this should not happen in Africa, since it does so in America. At the same time it would be unsafe to predict that it will behave in Africa as it behaves in Brazil, because in India and Ceylon, where the plant is really wild, I know from personal experience that it does not display any such tendency. It is for this reason that we have so far been directing our energies towards the introduction of this plant to the West Indies where the vital conditions are probably more like those of Brazil, and where the planting community are already more or less familiar with the idea of paper-making. In Trinidad, for example, a useful brown paper is now being made for local consumption, in a small paper-mill, from the dry sugar cane stems which form the waste product known as megasse, that is left after the extraction of the sugar.

But the introduction of the plant into West Africa is certainly well worth arranging for on experimental lines and, if approved, arrangements will at once be made to secure such supplies as may be available from India and Ceylon. The best plan will

will be to allow the rootstocks to come to Kew in the first instance. They will then be examined here to see if they be in good condition and will be re-sorted and repacked for shipment to as many different experimental stations in West Africa as may be decided upon.

I do not think the plant is so likely to succeed in East Africa. Still it is well worth a trial. There are, however, several reasons why I should not recommend the importation of rootstock's either from India or Ceylon owing to the natural susceptibility that there is to certain plants or parts of plants from these countries to be introduced because of the risk of introducing Coffee leaf-disease. Nor should I recommend, for the same reason, that seeds of the plant be introduced to East Africa from either of these countries. There are no nursery or seed firms in England who deal in the seeds of useful plants suitable for hot countries; that branch of trade is left to various English firms of repute in Ceylon and India. But fortunately there is a firm in Paris of the highest reputation who supply seeds of tropical plants for their own colonies and it will be easy to obtain at a trifling cost seeds of *Hedychium coronarium* for despatch to East Africa, Nyasaland and I would suggest also Uganda, without there being any risk of introducing Coffee disease. The only disadvantage of introducing by seeds in place of by root-stocks is that a rather longer period must elapse

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I do not think the plant is so likely to succeed in East Africa. Still it is well worth a trial there also. In this case, however, I should not recommend the importation of rust-free silver from Java or Ceylon owing to the natural unwillingness that there is to permit fibres or parts of plants from these countries to be introduced because of the risk of introducing Coffee leaf-disease. I should recommend, for the same reason, that seeds of the plant be introduced to East Africa from either of these countries. There are no nursery or seed firms in England who deal in the seeds of useful plants suitable for hot countries; that branch of trade is left to various English firms of repute in Ceylon and India. But fortunately there is a firm in Paris of the highest reputation who supply seeds of tropical plants for their own colonies and it will be easy to obtain at a trifling cost seeds of Hedychium coronarium for despatch to East Africa, Nyasaland and I would suggest also Uganda, without there being any risk of introducing Coffee disease. The only disadvantage of introducing by seeds in place of by root-stocks is that a rather longer period must elapse

9

elapse before there is a stock of plants sufficiently large to yield any considerable supply of pulp.

It may perhaps interest you to see some of the paper actually produced from the stems of Hedychium coronarium. I enclose two sheets accordingly; one is partially bleached, the other is unbleached.

Yours faithfully,

(Sd.) D. PRAIN.

The Right Honourable  
L. Harcourt, P.C.,  
Colonial Office,  
Downing Street, S.W.



2. Specimens of

“ Hedycheum “ paper

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ROYAL BOTANIC GARDENS, KEW.

BULLETIN  
OF  
MISCELLANEOUS INFORMATION.

No. 9.]

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1895	3 0	4 4	5 6
1896	3 0	4 4	5 6
1897	3 0	4 4	5 6
1898	3 0	4 4	5 6
1899	3 0	4 4	5 6
1900	3 0	4 4	5 6
1901	3 0	4 4	5 6
1902	3 0	4 4	5 6
1903	3 0	4 4	5 6
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*Continued on p. 3 of cover.]*

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ROYAL BOTANIC GARDENS. KEW.

BULLETIN  
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MISCELLANEOUS INFORMATION.

No. 9.]

[1912.]

LI.—NEW SOURCES OF PAPER.

(*Hedychium coronarium*, Koën., and allies.)

(With Plates.)

Early in the present year Messrs. Clayton Beadle and Stevens, of London, drew the attention of Kew to the value of *Hedychium coronarium* as a source of material for paper-making.

This plant, a member of the Natural Order Zingiberaceae, is a native of India, being distributed from the Himalayas to Ceylon and Malacca, ascending to 4000 ft. in the Khasia Hills and 6000 ft. in Ceylon. It is also recorded from Central America, the West Indies, New Zealand, Mauritius and West Africa (Corisco Bay). Many years ago it appears to have been introduced into Brazil and it has run wild in many of the States, being especially abundant at Morrettes in the State of Parana, where it has covered a large tract of swampy country.

The plant in its naturalised condition in Brazil is shown on Plate I. When the introduction to Brazil took place is uncertain. There is a specimen at Kew collected by Dr. Glaziou in 1869 and the presence of the plant in Brazil is recorded by Martius\* and K. Schumann.† These authors mention that the plant is known by the native names "Lágrimo de Moça" and "Escaldamao." According to some Portuguese documents quoted by Messrs. Clayton Beadle and Stevens the plant is sometimes known in Brazil as wild Jasmine.

The genus *Hedychium*, of which a good description by Baker is to be found in Hooker's *Flora of British India*, vol. vi., p. 225, is characterised by the horizontal tuberous rootstock, which bears the erect, elongated leafy stems. The leaves are distichous, oblong or lanceolate, with long clasping sheaths. The inflorescence forms a terminal spike.

\* Martius, *Flor. Bras.* III., iii., 37.

† K. Schumann, *Pflanzenreich* (Zingiberaceae), pp. 44 and 56. See also Usteri, *Flora der Umgegend der Stadt São Paulo* (1911), pp. 169, 170.

*H. coronarium* is best distinguished from other species of the genus by the following characters:—Inflorescence ellipsoid or ovoid; 3-5-flowered bracts which are densely imbricate in 5-8-spirals. Staminodia oblong-lanceolate, white. Labellum widely obovate, white with yellow sometimes near the base. Filament white.

At Kew the plant thrives under tropical swamp conditions in House No. 15 and is an object of beauty throughout the summer and autumn with its spikes of fragrant white flowers. The photograph reproduced on Plate II. is taken from one of the Kew plants, and the numerous, closely-arranged leafy stems springing from the creeping rhizomes can be well seen. At Kew the stems attain a height of about 3-4 feet. In Brazil the plant is described as growing spontaneously and thickly and completely covering the land. The stems are said to reach a height of 1-1½ metres when growing thickly and to be about 2-4 cm. in thickness. On the margins of streams, however, the stems grow as high as 2 metres. After cutting down the stems it is found that some 4-5 months must elapse before a full growth of the stems is made.

In order to make certain of the identity of the Brazilian plant whose paper-making qualities had been tested, application for specimens was made to H.M. Consul at St. Paulo for specimens of the plant. Thanks to the kind services of the Acting Consul and H.M. Vice-Consul at Curitiba, a specimen of the plant known in that region as *Hedycheum coronarium* has been received at Kew. This proved to be *Hedycheum coronarium*, as did also the specimens sent to Kew by Messrs. Clayton Beadle and Stevens from Parana.

The value of the plant for paper-making was brought to our notice by a request for fresh material for the purpose of experimental investigation. Messrs. Beadle and Stevens had already satisfied themselves as to the good qualities of *Hedycheum* fibre from the dried material they had received from Brazil, and were naturally anxious to test it in the green fresh condition. The paper-making qualities of the fresh material supplied from Kew were found to be identical with those of the dried stems, and the plant appears likely to be a very valuable source of material for the paper-maker.

In a letter to Kew, Messrs. Clayton Beadle and Stevens write:—

"Papers produced from this fibre have even greater tensile strength than the strongest manilla papers produced. The strongest manilla papers have a strength of 6000 or 7000 metres 'breaking length.' This paper has from 9000 to 10,000. Its elasticity and folding qualities are exceptional. Moreover, it can be made to bear ink and possess parchment qualities without any sizing or other special treatment.

"The reason of this we find to be due to the presence of the cells associated with the fibre, which are of a semi-gelatinous nature, when chemically treated, and dry into the interstices of the paper and produce natural parchment."

Messrs. Clayton Beadle and Stevens recently presented a paper to the Eighth International Congress of Applied Chemistry\* on

\* The paper-making qualities of *Hedycheum coronarium* represented from Original Contributions, Eighth International Congress of Applied Chemistry, vol. xiii, pp. 39-45.

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\* The paper-making qualities of *Hedychium coronarium* represented from Original Contributions, Eighth International Congress of Applied Chemistry, vol. xiii, pp. 89-45.





PLANT PROTOGRAPHY, NOT TO BE REPRODUCED WITHOUT PERMISSION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE



the paper-making qualities of *Hedychium coronarium* and the following extracts are taken from a copy of the paper sent to Kew by the courtesy of the authors.

A chemical analysis of dried specimens as received was made with the following results:—

"A. Whole stem as gathered.

"B. Whole stem after passing through crushing-rollers.

	A	B
Moisture .. .. .	9.7%	11.2%
Ash .. .. .	4.5	4.8
Cellulose .. .. .	43.0	48.0
Extracted by chemical treatment	42.8	36.0
	100.0	100.0

Cellulose air-dry on air-dry allowing for losses .. .. .

	A	B
Cellulose air-dry on air-dry allowing for losses .. .. .	41.0%	44.0%

Raw material in the form of B is conveniently treated by boiling with 2 per cent. of soda at a pressure of three to five atmospheres. On washing this material, the yield of boiled product including all the fibrous constituents of the plant is 60 per cent. The peculiar characteristics of the pulp are largely due to the presence of the oval cells of the pith, which are retained in the above 60 per cent. If these are removed by washing, the yield of fibre proper is 50 per cent. of unbleached material of 100% weight.

"We discovered that the pith cells, which can be retained or not, according to requirements, possess very peculiar qualities. If taken alone, the unbleached cells when dried down go to a horny mass which can only be broken with very great difficulty with a hammer, and are softened only with difficulty when boiled in soda. If retained in the paper, they give it parchment-like properties to an extraordinary degree. They also render the paper ink-bearing without the addition of any sizing material. . . . On the other hand, the paper made from *Hedychium* from which the cells are removed is of a soft nature and of medium strength, but that in which the cells are retained, as will be seen, gives higher 'breaking lengths' than any manila paper that we have so far had the opportunity of examining. The oval cells, therefore, 'parchmentize,' strengthen and size the sheet.

"The pulp, after boiling in soda and beating, if examined under the microscope in the presence of chloridide of zinc shows:—

(a) Oval cells stained blue.

(b) Long wide fibres something like chemical wood, stained blue.

(c) Numerous shorter and solid-looking fibres, stained yellow.

(d) Small epidermal cells attached to one another, stained yellow.

The length of fibres is given in a table which is not reproduced here. The means of the results of measurements under the microscope of numerous fibres are as follows:—

"1. *Hedychium* fibres, unbleached, not beaten, 2.61 mm.

"2. *Hedychium* bleached, not beaten, 2.56 mm.

"3. *Hedychium* cells washed through 70-mesh wire, measured lengthwise, 0.138 mm.

"4. *Hedychium* cells washed through 70-mesh wire, measured crosswise, 0.083 mm.

"5. Best strong thick manila cable paper, 2.835 mm.

"6. Ditto, thin, 2.89 mm."

"It will be observed that the mean size of the cells, taking the mean of the two directions [mean of 3 and 4], is 0.11 mm., or less than 1/20 of the length of the fibres which measure 2.58. It can be understood, therefore, that such small particles as the oval cells will pass through a 70-mesh sieve of the washing drum, the holes of which would be about 0.2 mm., but the same sieve would of course retain the fibres proper. It will be observed also that the mean length of the fibres of the longest and strongest manila papers, which is about 2.85 mm., is only slightly in excess of that of the *Hedychium* fibre, but, as will hereafter be seen, the *Hedychium*, on account of the peculiar nature of the fibres and the cells, is capable of producing a stronger and in many respects more serviceable paper. Moreover, the smallness of the *Hedychium* cells in comparison with the fibres enables the cells to fill the interstices between the fibres. Moreover, these cells, being of a flocculent, sticky and glutinous nature, act as a natural sizing material. We mechanically separated and weighed the cells and fibres with the following results:—

"The actual amount of fibre proper and cells in *Hedychium* unbleached paper, the cells of which have been entirely retained, we find to be as follows:—

Cells	...	...	17.3%
Fibre	...	...	82.7

"When the pulp is completely bleached so as to produce a white paper, the proportion by weight of cells and fibres in the finished paper is as follows:—

Cells	...	...	14%
Fibre	...	...	86

"We have made several trials of this material on the paper machine. The beaten fibre, especially that containing the pith cells, when left in an unbleached condition, has an extremely greasy feel, enough to lead one to suppose that it would only part with its water with very great difficulty on the paper machine. Unlike most greasy feeling pulp, however, the water drains from the machine wire with great rapidity. We have seen the pulp on the wire of the paper machine on five or six occasions. In one case, when making a parchment paper, we observed that the water left the wire quickly after the apron—in fact, in one-quarter of the space taken by a wood-pulp paper made on the same machine at the same speed. This argues in favour of the possibility of comparatively fast running on the paper machine, in spite of the greasy feel and the parchment-like qualities.

"For the purpose of making a comparison of papers producible from the *H. coronarium* with papers with which it is likely to come into competition, we carried out a number of tests as to strength,

breaking strain, elongation, bursting strain and greaseproof qualities. These are contained in Table B [not reproduced].

"We draw attention to this fibre as we believe it may become of great industrial importance to the paper trade. Where circumstances are congenial to its growth, the plant spreads to the exclusion of all other vegetable growth by means of its rhizomes, so that it can be harvested at least once a year, producing a heavy crop. It is an easy pulp to manipulate. It is capable of producing a paper of exceptional strength and can be worked either bleached or unbleached. The fact that the paper in its natural state, without the addition of any materials whatever, can be made to possess greaseproof and self-sizing qualities is a point of commercial importance."

Messrs. Clayton Beadle and Stevens also inform us that they have dressed some of the fibre from the green stem, and the tensile strength tests indicate that it is almost exactly similar in strength to the best pure manila binder-twine. Samples both of the paper and the fibre have been presented to Kew and have been placed in the Museum.

Owing to the very remarkable paper-making qualities of *Hedychium* and the ease with which the plant spreads under favourable conditions in the tropics, it seems likely that it may be in considerable demand in the near future.

#### AMOMUM AND ALPINIA.

As *Hedychium* has proved to be so valuable a plant for paper-making, stems of *Amomum hemisphericum* and *Alpinia nutans* have also been submitted to Messrs. Clayton Beadle and Stevens for examination as to their paper-making qualities.

In the accompanying report they mention that in neither case do these plants yield papers showing the self-sizing qualities to be observed with *Hedychium* and under certain conditions also with manila waste, bagasse, and also with banana fibre. The Report is as follows:—

"These plants were passed through sugar-crushing rollers for the removal of juices and to reduce same to the condition of tow. They were then boiled under pressure, each with 20 per cent. of soda, the *Amomum hemisphericum* being boiled for 4 hours at 40 lbs. pressure and the *Alpinia nutans* for 6 hours at 50 lbs. They were afterwards bleached, and the yield of unbleached and bleached fibres expressed on the original green weight of stem as received, as follows:—

	<i>Amomum.</i>	<i>Alpinia.</i>
On green stem as received.		
Yield—unbleached	7.44%	6.93%
bleached	6.36	4.95

"If expressed upon the dry weight of stem the figures are as follows:—

	<i>Amomum.</i>	<i>Alpinia.</i>
On dry stem.		
Yield—unbleached	58.2%	50.0%
bleached	49.6	41.5

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