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Perak Museum Notes. Vol. II Part 11.

ON

RUBBER AND RAMIE CULTIVATION IN PERAK

AND *CHAPTER V* OF

TIN MINING IN PERAK,

BY

L. WRAY, JUN.,

M.I.E.E., F.Z.S. COR. MEM. P.S., ETC.

TOGETHER WITH PAPERS ON

FICUS ELASTICA AND *TAPPING OF PARA TREES AT KUALA KANGSAR,*

BY

A. B. STEPHENS AND R. DERRY.

AND

A REPORT ON THE PERAK MUSEUM.

Bot. Garden, 1898.

Taiping:

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SOME ACCOUNT OF THE TIN MINES AND THE MINING INDUSTRIES OF PERAK.

By L. Wray, Jun.

Chapter V.

HYDRAULIC MINING.

Hydraulic mining, as carried on in California, is a method of employing a jet of high pressure water to break down the gravel or earth that contains the gold, and wash it into a long line of boxes. As it passes down them the earth and gravel get broken up, and the gold is caught and retained in the bottom of them by becoming amalgamated with the mercury which is placed there for that purpose. The bottoms of the sluice boxes are covered in different ways with wood, iron or stone, with the object of affording interstices in which the gold and mercury may collect, and also to withstand the wear and tear of the water, stones and gravel which, naturally, is very great.

The top part of the sluice is narrow and deep, with a fall of one in nine or twelve, and it should be long enough to thoroughly break up the clay. Then come one or more series of iron bars, which are so arranged that the fine gravel passes through them while the stones are ejected. The lower part of the sluice is wider and at a lesser grade, so as to give the gold more chances of sinking and coming in contact with the mercury in the bottom of the boxes between the riffle bars. These are bars of iron, or wood, or iron-faced wood, set at intervals either across the boxes or in the direction of their length. The sluices are often over a mile in length, and some tons of mercury are put into them to collect the gold.

At intervals the current is diverted from the sluice boxes proper into wide riffle-covered tables, known as under currents. In these, the flow being less, the finer gold settles down between the riffles and is caught by the mercury. As many as a dozen of these under currents are put into some of the sluices.

The principles involved are therefore very simple, firstly, the pay-dirt has to be broken up and, secondly, the heavy portions of it allowed to fall down into the spaces between the riffles, where

they come into contact with the mercury and remain until the time comes to clean up the sluice. It is evident that the amount of water, and the size and grade of the various parts of the apparatus, must be so adjusted that the sand and gravel in no part of the length of the sluice shall settle down into a compact mass at the bottom of the sluices or between the riffle bars, for wherever packing, as it is called, takes place that portion of the apparatus is rendered inoperative, The whole of the material should be in a state of movement, gently, on the tables where the fine gold is to be caught, but still in motion.

The difference of the conditions between the requirements of a sluice to catch gold and to catch tin are as follows; the catchment area must be much larger and, as the tin cannot be caught and retained by solution in mercury, the sluice must be cleaned out at more frequent intervals or the tin will drift down the sluice and pass into the tail-race. The object aimed at is to produce on the tables and between the riffle bars a rich concentrate, which can be periodically removed from the sluice and washed in an ordinary washing box until it becomes sufficiently pure to be sent to market.

In the year 1892 the first attempt was made in Perak to work tin land by hydraulic sluicing, at Teluk Bharu, about two miles from the town of Ipoh, in Kinta, by the Leh Chin Mining Company, under the management of Mr. F. D. Osborne. Eight-inch pipes were laid down from the intake at the foot of the Kledang hills to bring the water down to the mine. They were about two miles long, and there was a fall of some two hundred feet, the monitor being used with a two-inch nozzle.

The land, however, proved to be unsuited to this method of working, as it was too flat and there was insufficient fall to allow the tailings to discharge into the Pari river. The result was the tailings rapidly banked up, filled the sluice boxes and stopped all further work until they could be dug out and the channel cleared again. The Government also objected to the tailings being discharged into the Pari river, as they would be likely to silt up the Kinta river, which was then, and until the railway was opened, in 1895, the highway on which all the traffic with the port of Teluk Anson was borne.

The pipes and monitor were therefore taken up and moved to Gopeng, where they are employed to bring water from the hills to near the town of Gopeng, to work the land belonging to the Gopeng Tin Mining Company, Limited. The erection was begun in August of 1892, and was carried on under the direction of Mr. E. R. Pike, who resigned his appointment

as Inspector of Mines under the Government to become the Manager of the Company. This position he held until his death in 1895. Messrs. F. D. Osborne and C. Ephraums then took over charge of the works.

The pipes are eight inches in diameter, the pipe line is about five miles long, there are some two and a half miles of open ditching, and the intake is two hundred and forty-nine feet above the mine. The pipes are riveted sheet steel, and join by slipping one into the other, they having a slight taper sufficient to allow of this. The monitor works with a two-inch nozzle as a rule. The whole plant was procured from America, which is the seat of the hydraulic mining industry. As first put up there was a sluice of about four hundred feet in length and three feet in width, near the Ipoh-Gopeng road. It worked very unsatisfactorily, and the tailings were so good that a number of people used to wash them by hand in "dulangs" and make a living out of selling the tin-sand to the Company at quite a low price.

When the mine was visited in July, 1896, the plan of working was as follows. During the night the jet (a two-inch one) was used in cutting down the earth, which was from six to nine feet in depth. Twelve Chinamen were employed at this night work. The gravel and earth was partly washed into the rock-cut, and the rest left to be dealt with in the day time. In the morning a gang of forty Malay and Kling women go into the rock-cut with "dulangs" and scoop up the sand and earth in it, washing it off in the stream itself, then take up a second dishful and so on, putting the tin sand into a can or other receptical after washing each "dulang" of earth. Meanwhile the monitor plays with reduced pressure on the earth cut down during the preceding night, and washes it into the ditch. This goes on for eight hours on ordinary days, and for twelve hours occasionally, when it takes longer to get through the material cut during the night before. For this eight hours' work the women are paid 40 cents, and for the twelve hours 60 cents.

The rock-cut is merely a rude ditch cut in the stiff clay, "kong," underlying the pay dirt. It is some five hundred feet long and about two feet wide. It has a few wooden stops, but neither riffles nor riffle stones, nor is it paved with wood or stone. The women stand all along at intervals in it plying their "dulangs." During the day ten men, mostly Chinese, are also employed, thus bringing up the complement to sixty-one hands for the one jet. These day men look after the monitor, clear away timber and roots, clean the crude tin-sand

in "lanchuts" and afterwards with brass sieves, used like a "dillueing" sieve, until it is clean enough for the Straits Trading Company to buy, that is to say from seventy to seventy-three per cent of metal.

This system, if it is permissible to dignify it by such a term, is a combination of hydraulic ground sluicing and panning. Fortunately the land being piped is so rich that this rude method of working pays handsomely. With a properly constructed sluice, working for say twenty hours a day, about double the amount of ground could be cut down and put through with from one third to one half of the labour. The earth is free and loamy, so there is little or no trouble with clay balls or stones. The tailings are reported to be too poor in tin to be worked at a profit by the women. An offer of 10 cents per "kati" of tin sand not being considered remunerative.

The next venture was at Benkong, in the district of Batang Padang, some twelve miles from the town of Tapah. In 1895 Mr. A. H. A. Woodgate, of the firm of Messrs. W. F. Higginson & Co., put up there half a mile of six-inch pipes, with a monitor of the same pattern and size as that used at Gopeng. The head of water was two hundred feet, and the nozzles used varied from one to three inches in diameter, according to the amount of water available. The line of sluice boxes was thirty inches wide by four hundred feet in length; below which there was a tail-race one thousand feet long. The full water supply being intermittant the sluice did not work well, and was discarded in favour of a ditch of about a thousand feet in length, which had previously been used by the Malays for their ground sluicing.

The upper portions of the ditch are planked and graded in sections, with perpendicular drops or falls of fifteen feet between each section. Of these the upper sections are cleaned up every three days, and the lower ones once a month. The water supply being insufficient to work the monitor with full effect it was done away with. The six-inch pipes from the intake, for a distance of six hundred and sixty feet, giving a fall of two hundred feet, were retained, but they are then reduced to four inches, at the end of which a flexible nozzle has been used, with better effect than could have been produced with the monitor. The land was being worked with a face varying from twenty to forty feet in height, and being generally very friable comes down in large masses; and the water delivered by the four-inch pipes being insufficient to treat this properly, a further supply is introduced through an open head-race at a lower level.

Messrs. Aylesbury and Bamforth next put up six-inch pipes at Bruseh, in Batang Padang, in the year 1895. A short sluice of about a hundred and fifty feet was at first employed, but it gave the most unsatisfactory results. In the year 1896 experiments were begun with the view of improving the working of the sluices, and by July the form which will now be described had been evolved.

The water is brought from a stream called the Sungei Gepai by means of a long ditch cut out on the face of the hill, with wooden flumes to carry it across the ravines and over those places where the hillside is too steep to allow of a ditch being dug. There are four miles of open ditching, and over three thousand feet of flumes. Both ditch and fluming are variously graded, depending on the nature of the soil passed over, and capable of supplying water sufficient to keep three monitors at work using six-inch piping with a fall of two hundred and fifty feet At the end of the ditch is the intake box. This is simply a wooden tank, fitted with a grating to catch and prevent leaves, sticks and other things from entering the pipes with the water. There are water gates between the intake box and the ditch, and also an overflow to allow the surplus water to escape without doing damage to the plant. The pipes enter the lower part of the intake box, and are then simply laid on the surface of the hillside down to the monitor. The pipes are of riveted steel plates, slightly larger at one end than the other so as to allow of the smaller end of one fitting into the larger end of the next. They are eight hundred feet in length, and the head of water is two hundred and thirty feet, that is to say the vertical height from the working face to the intake box is that distance. There are valves at the intake box, and also near the monitor, so as to be able to control the supply of water or to shut it off entirely. The monitor is of the usual type, with nothing particular about it. It is a stout conical steel tube mounted at its larger end on an universal joint, so that the operator can turn it about with ease in any direction. At the narrow end there is a screw into which different sized nozzles can be fixed, and within the conical tube there are four straight flat ribs of iron projecting from the sides towards the centre. These are to give the water a straight course within the delivery tube of the monitor, so that as it issues from the nozzle it will maintain a rectilinear direction. Without these ribs the water would have a tendency to move in curved lines, varying with the changing position of the monitor tube in relation to the pipe line. These irregularities in the direction of the water of the jet cause it to break up into spray as soon as it leaves the nozzle and much diminish the striking power

of the stream of water, and also the distance to which it will carry. The rifling, as these ribs are most inappropriately called, is therefore a very important portion of the monitor.

The jet in use at the time of the writer's visit to the mine was one and a half inches in diameter, but a two-inch nozzle could be used with the supply of water available, and after some slight alterations had been made in the sluice it was possible to use the two-inch jet. This gives two and a quarter times as much water as the one and a half inch jet, and consequently will deal with that amount more of wash-dirt.

In working, the jet is directed against the bank of earth, which rapidly breaks down under the impact of the stream, and is carried by it into a ditch leading from the working face to the head of the sluice boxes. The length of this ditch varies from day to day as the work proceeds. From it the water and dirt flow into a narrow sluice box set at a steep grade. The first series of boxes is fifty feet in length by ten inches wide by ten inches deep, and the grade is about one in six. Next in order come fifty feet of boxes, twenty inches wide by ten inches deep, set at one in ten; then a hundred feet of boxes, thirty inches wide with a grade of one in twenty. Inside some of these are zigzag riffles, the office of which is to throw the water and gravel violently from side to side in the boxes and disintegrate the clayey portions of it. At the end of this line of boxes comes a drop of five feet; that is the water falls sheer down from one box into another placed five feet below it. The object of this is to further break up the earth and liberate the tin. Beneath the drop and extending at right angles to it are twenty-five feet of thirty-inch wide boxes, and at the end of them a "grizzley" (that is a slanting grate of iron bars so arranged as to throw out the stones) and a second drop of six feet. At the bottom of this the sluice is widened out to forty inches, and the grade lessened to one in twenty-four. These latter, termed wash boxes, are fifty feet in length, and their object is to catch the tin-sand, as will be explained further on. At the end of these five boxes the sluice narrows again to thirty inches, and the grade increases to one in eighteen. There are eighty feet of these boxes, and they are furnished with transverse riffle bars of three by two and a half inch wood, fixed at intervals of twelve inches apart. Sixty feet of similar boxes, also furnished with riffle bars, follow these on a grade of one in twenty-four. Lastly come fifty feet of fifty-inch wide wash-boxes, at a grade of one in twenty-four. These, like the wide ones higher up the sluice, are employed to save the tin-sand.

Following the sluice boxes is a tail-race of half a mile

in length, leading into the Bidor river. It is about two feet wide, and has staked sides and an earthen bottom. The water not employed in the jet, and that used for washing purposes, is led by a ditch under the end of the sluice boxes into the top of the tail-race, so as to keep it clear of silt.

There are several bends in the course of the line of sluice boxes, and many small drops of six to ten inches, besides the two large ones already mentioned. The boxes are mostly ten feet long, constructed of two-inch meranti planks. The total length, exclusive of the face ditch, is four hundred and sixty-five feet.

The method of working is as follows. The jet of water breaks down the bank of tin bearing earth, and washes it down into the face ditch, from thence it enters the sluice boxes. Two men are employed in the face ditch to help along the heavier portions of the gravel with "changkols." Once in the sluice it goes by itself till it comes to the "grizzley," where a little attention is required to clear the bars from time to time of wood, roots, etc., which are apt to choke it up. Then in the first set of wash boxes there are some men employed with long-handled "changkols," pulling the stuff upwards against the stream. In fact they work just in the same way as in a "long tom," or as it is called locally a "lanchut." These boxes are furnished with a three or four inch high stop at the lower end of each, so that there is always a certain amount of gravel and sand in them, and the object of stirring this up with the "changkols" is to allow the water to wash away the lighter portions of it and form a concentrate rich in tin-sand. This concentrate is lifted from the boxes three times a day, that is every eight hours, for which purpose clean water is sent through the sluice for a short time previously to clear it of mud. The concentrate is then put, a little at a time, into an ordinary "lanchut" or "long tom," and washed until it is clean enough to be sent to the store as tin-sand.

In the riffle boxes there are one or two men with iron rakes to prevent stones from clogging them up. When they are in proper working order the water goes in regular waves over each, and down into the cavity formed between them, where a good deal of tin is caught. These boxes are cleaned out every ten or twelve days, according to circumstances, and the concentrate washed in the same way as that from the wash boxes.

At the lower wash boxes the same procedure is followed as in the first set. The tin-sand caught here is mostly fine-grained, as might be expected. Any tin which escapes the riffles and wash boxes settles in the tail-race, and this will be cleaned

up from time to time as occasion offers; that is when the monitor has to be stopped from want of water or other causes, or when repairs to the sluice boxes are being carried out.

Shortly after the writer's visit to the mine the wash boxes were duplicated, and it was then possible to use the two-inch nozzle without the tin-ore being carried down the sluice by the increased volume of water. The men employed on this sluice are twenty-four in number, working in shifts of eight men. The shifts are four hour ones, so that each man does two shifts a day. Here the men seem to prefer short shifts to the eight hour ones customary amongst English miners. The yield of tin-sand from the one sluice was, at the time of the writer's visit, about five tubs a day of twenty-four hours.

Half a mile away, on the same concession, a second monitor was erected, the water supply for which is derived from the same source as the other and comes down, firstly, in six hundred feet of six-inch pipes, and then through eight hundred feet of four-inch ones. These latter are welded and are fastened together with clamp joints. The pipe line is therefore one thousand four hundred feet in length, the fall from the intake to the monitor being about two hundred and fifty feet. Over four hundred feet of sluice, riffle and wash boxes follow the face ditch and the final wash boxes are twelve feet wide, employing three men to catch the tin-ore. With this exception the sluice and the method of working it are the same as that above described. The tailings are carried through a race a quarter of a mile long into the same large river.

After working satisfactorily for some time the tin bearing earth became so clayey and hard that, with the pressure available, the jet from the monitor would not break down a sufficient quantity in the day to pay expenses. This was very unfortunate for the owners, who had spent so much time and money in perfecting the working of the sluices. However, the problem of the adaptation of the gold sluice to the exigencies of tin mining has been solved by them, and it now only remains for someone to apply it in the mining of some suitable land to establish hydraulic sluicing on a permanent basis in the Native States.

The conditions necessary are, firstly, good tin bearing earth of not too hard, clayey or stoney a character. Secondly, a supply of water with a head of from two hundred to five hundred feet. Thirdly, a sufficient fall beneath the land to be worked to allow of the building of the sluices and, fourthly, an outlet for the tailings, where they will either be swept away by a large river or fill in worked out land.

FICUS ELASTICA.

(Extract From Mr. A. B. Stephen's Report Of His Tour Through Some Of The Indian Forests.)

The India-rubber plant was first planted by the Indian Forest Department in Assam as far back as 1872. Many ways of planting it were tried: first of all with cuttings, and some of them did very well, but as a whole they were not a success. Cuttings were merely put in on the level ground, and in time they sent out roots and leaves and became good sized trees. Someone then said that "nature's way" was the proper method to adopt, so young seedlings were planted amongst the branches of the jungle trees, at their forks, a large number of these died; and afterwards they were planted in baskets, and the baskets and all put up in the trees with the soil, many of these may still be seen up the trees and, although they are twenty years old, many are scarcely any bigger than the day they were planted. They were usually placed twenty or thirty feet high, and in some cases seventy to eighty feet high; the consequence has been that their roots have failed to reach the ground, and so they merely just exist, and do not thrive. In a few instances the roots managed to reach the ground, and in these cases they flourished and became large trees. After some years somebody suggested seed planting, and that system has now been adopted, and is considered a great success. Seed beds should be made east by west for shade purposes, not over four feet wide. Raised beds, at least a foot high, with stone or brick sides to prevent wash during rains, and when they are watered. The soil must be well pulverised and sifted, and fine charcoal powdered up together with wood ashes mixed with it, and then the seed should be planted on this, and about three-quarters of an inch of the mixed soil and ashes laid over the seed. In Assam the seed ripens in December, and it is planted then and takes some three or four months to germinate, but I am of opinion that perhaps if planted say in the middle of February it would germinate at the same time, but I may be quite wrong. After the seedlings are about three inches high they are picked out into new nurseries, each plant being put in at about one foot apart; here they are allowed to grow up till they are three or four feet high. It is then decided in which parts of the forest these are to be planted, and in the forests fresh nurseries are made, these are stockaded

with very strong wooden and bamboo fences to keep out elephants and deer, both animals being very numerous, and both fond of the rubber plant. In these nurseries the plants are placed three feet apart, and here they are allowed to remain until they are from fourteen to twenty feet high, which is usually when they are three years old. They generally grow up with merely one whip-shaped stem. This latter process might with advantage be done away with in this country, except where there are elephants.

The system now adopted is to cut lines, twenty feet wide and seventy feet apart, through the jungle, clearing everything. Even very tall trees adjoining these lines should be felled, to prevent drip from their leaves, and too much shade. Up these lines, at every thirty-five feet, mounds, six feet high with a base diameter of about ten feet, are raised, a rubber plant is planted on top of each of these, care being taken to keep the top of the mounds more or less flat to allow rain water to sink into them. The plants are very hardy, and are generally planted with bare roots, but only in the wet season will they come on; if planted during the drought they usually die. If planted in the rains a tree seldom dies unless pulled out by elephants, and if there is good rainy weather the leaves seldom wither on the plants when transplanted. The reason that planting on mounds is condered so good is because the plant usually sends out its roots just above the earth, and these run down over these mounds to get their nourishment, but great care should be taken to send men every month or two to cover up these roots with earth; every time this is done the plant seems to go ahead, and sends out more roots and shoots. This should be done until the plant is about six years of age, when it may be left to take care of itself. The plant has no tap root, all roots being surface feeders. This system seems to be a very great success, and the trees of twelve years of age are fully as large as those that were planted twenty years ago on the old system. I saw several of the stockaded nurseries, but these we could avoid, and put our plants out when they were two years old, and by so doing I believe the trees would more quickly throw out their branches, and grow into better shaped trees earlier.

I saw quantities of rubber of all ages, from the nursery stage up to those of over twenty-two years of age. Very little jungle clearing is necessary as the plant grows very quickly, so it is merely necessary to keep the lines more or less clear: cross-lines every few hundred yards or so very greatly facilitate the superintending of work of this kind. The roots of the rubber run all over the surface of the ground, and twist themselves up together,

and even grow into one another, so that by tapping a root you may be in reality tapping several. After about twelve years a good deal of the intervening jungle begins to get killed out, and after twenty years it is difficult to find any but rubber trees, and a few shrubs and grasses growing underneath. So in this way a rubber plantation when once well started practically clears its own jungle. It is considered inadvisable to plant closer than the distance given above, as it is believed if a tree were killed its companions might also die. I saw some instances where the Forest Department had tried to kill out every other tree where they were planted too close, and although they had been dreadfully tapped for three years in succession they looked quite as healthy as the intervening ones, which had not been tapped at all. I saw, in some of the eight year old plantations, that the branches up the lines had met, and the canopy up the lines was quite complete. At twelve years the canopy the other way was complete, therefore completely covering the ground.

The way the India-rubber tree is killed by the natives is that they dig small holes under the large main roots of the trees, and then cut them quite or almost through, and let them practically bleed to death. In this way they get a great quantity of rubber at the expense of the tree dying.

I think that planters who have spare jungle could not do much better than follow the lead of the Indian Forest Department. The expense would be very small indeed, probably jungle felling would only cost $3 per acre, and the seventeen mounds per acre not over $2. Then there would be the nurseries, and a few coolies occasionally just to keep the lines open and throw a little earth on the roots of the young plants for about six years, when they could take care of themselves.

It is found that at twelve years a tree will yield annually 1 pound of rubber; at fifteen, 2 pounds; at twenty, 3 pounds, and it is believed that at one hundred years they yield 20 pounds per annum. At this rate the first tapping would probably pay all previous expenses. I believe that after I left the plantation some experiments were made to see what the trees actually yielded. I am writing to Mr. Copeland, who is in charge of the plantation, for information. The Government have planted 2,200 acres, and are putting out more as quickly as possible.

Coolie labour in Assam is very dear, the Forest Department pay 32 cents per diem, and have difficulty in getting men even at that rate. The planters have to bring their labour from Central India, and pay a very large sum for it. Second class coolies

which arrived at Namgoan estate when I was there, cost Rs. 142 each individual. First class coolies (which are almost impossible to get) cost Rs. 20 more.

I can obtain India-rubber seed, *Ficus Elastica*, for persons wishing to try what they can do in this way in this State, if the Government wish me to do so, but it is too late now, and we could not get any before the end of the year.

RUBBER GROWING IN PERAK.

By L. Wray, Jun.

Seeds of Para Rubber were first obtained some twenty-four years ago, and the introduction is thus described in the *Economic Products of British India*—" On the 4th June, 1873, the Director of Kew Gardens received from Mr. Markham some hundreds of seeds which had been collected by Mr. J. Collins. Of these less than a dozen germinated, and six were in that year taken out by Dr. King to Calcutta. These did not succeed well in Calcutta, and it was accordingly arranged that Ceylon should be established as the depot for supplying young plants to the parts of India where *Hevea* cultivation was thought possible. On the 14th June, 1876, 70,000 seeds were received at Kew from Mr. Wickham (who was paid for them at the rate of £10 per 1,000); 4 per cent germinated. Of these, 1,919 plants were sent to Ceylon in 38 Wardian cases, in charge of a gardener, and 90 per cent reached in excellent condition." It must have been some of these plants which were procured by Sir Hugh Low, for in his Annual Report for the year 1883 he says that the trees at Kuala Kangsar were six years old. In the report for the previous year he says that "seeds and plants of *Hevea braziliensis* have been distributed to Java and Singapore, to Ceylon and to India." These original trees are therefore now about twenty-one years old, and the second generation of trees at Kuala Kangsar are some fourteen years old.

In 1887 some seeds were obtained from the Kuala Kangsar trees and planted in the Museum grounds, Taiping. The soil is very bad, the land having all been mined over, but still the trees have grown well and have attained, in the ten years which have elapsed since they were planted, a considerable size.

Finding that they grew so well I ventured, in 1891, to write to Sir F. A. Swettenham, the then British Resident of Perak, suggesting that they should be planted on waste lands and, as a result, Mr. O. Marks, then Superintendent of Government Plantations, put out a number of trees at Kuala Kangsar, which are now about six years old, and are doing very well It is much to be regretted that more were not planted at that time,

as by now they would be valuable, not only as rubber but as seed producers.

The tree has also been planted at Parit Buntar, where it grows well. It is in the garden of the District Magistrate, and close to the river. The land is occasionally flooded by the river, and in the ordinary way at high tide the river is only a foot or two below the level of the surface of the ground. The river is quite salt enough for the nipah palm to grow well on its banks.

It has been planted at Setiawan, also on low land near the sea; at Tapah, Batu Gajah, in Kinta, and other places in the State, and in all it has grown well.

It may, therefore, be stated that it will thrive in any locality, from the bakau swamps to the foot-hills, and on any soil from rich alluvium to old mine heaps.

So far I have not noticed that it has any enemies which do it serious injury. When large areas come to be planted up there may arise trouble with some pest, but at present there does not appear to be any indication of such a contingency.

Hitherto the trees have been planted singly and, as might be expected, they have grown with short trunks and bushy tops. To be a success, that is to yield large quantities of rubber, the tree must be planted so that it will run up and form a tall, straight, branchless trunk.

There is little to guide one on the subject, but from fifteen to twenty feet apart would appear to be about the correct spacing. At twenty feet it might be necessary to plant something in between to keep them from early branching, but this would not be necessary at fifteen feet. In Larut, at an estate at Kampong Dew, they are being planted at ten by ten feet, that is 544 per acre. It is very close, but it is the intention, I am informed by Mr. Waddell Boyd, the Manager, to thin them out later on to twenty by twenty feet, or 108 per acre, tapping the intermediate trees, that is those which are ultimately to be thinned out, as early as possible and as severely as they will stand, while the others are allowed to grow to a large size before tapping.

With a view to giving some data respecting the growth of the trees, I have measured some of those in the Museum grounds. These trees, it is to be remembered, are ten years old and are planted on mined land of the poorest quality.

A.	Total Height	77	feet.	Girth of Trunk at 3 feet,		3	feet	8	inches
B.	,,	89	,,	,,	,,	4	,,	3	,,
C.	,,	98	,,	,,	,,	4	,,	9	,,
D.	,,	69	,,	,,	,,	5	,,	3	,,
E.	,,	74½	,,	,,	,,	5	,,	5	,,
F.	,,	75	,,	,,	,,	5	,,	5	,,
G.	,,	60	,,	,,	,,	5	,,	2	,,
H.	,,	64	,,	,,	,,	3	,,	4	,,
I.	,,	77	,,	,,	,,	5	,,	6	,,
J.	,,	69	,,	,,	,,	3	,,	3	,,
K.	,,	67	,,	,,	,,	3	,,	11	,,
L.	,,	83	,,	,,	,,	4	,,	5	,,
M.	,,	67	,,	,,	,,	3	,,	11	,,

For these thirteen trees the mean height is 74 feet, and the mean girth, at three feet from the ground, is 4 feet 2 inches. This gives a mean annual growth in height of 7 feet 3 inches, in circumference of 5 inches, and in diameter of 1·6 inch.

The best grown of these trees is *A*, which has a trunk of 21 feet to the first branch, its diameter being, at three feet from the ground, 14 inches; at six feet $12\frac{1}{8}$ inches; and at twenty-one feet, $11\frac{1}{2}$ inches. This tree is in between others which have, by shading and crowding it, induced it to grow up straight and branchless.

The greatest difficulty in planting Para is the very short time which the seed remains good after it falls from the trees. The time which elapses before they are planted should not under any circumstances be longer than a week, and if they can be planted before this so much the better. Sown at once nearly all germinate, but each day which intervenes increases the number of failures, till at the expiration of ten days or so none grow.

The trees are very prolific seed bearers. Those in the Museum grounds have this year yielded nearly 14,000 seeds, or to speak more correctly, that number have been collected. Most of the trees are planted by the side of a large ditch, and all the seeds which fall into it are at once carried away as they are very light and float on the water. The seeds have been distributed, 3,000 given to the Jebong Estate and 11,000 to the Sam Sing Estate.

At fifteen by fifteen feet 14,000 seed would be enough to plant $72\frac{1}{2}$ acres of land. Where the land is ready it is certainly an advantage to plant the seed at stake, but where this cannot

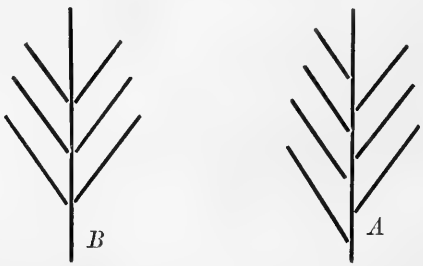
be done not much loss would follow planting in nurseries and then transplanting. The thing to avoid in this method is the production of double stems near the ground, caused by the original shoot dying out or being broken off.

In the first few years a little judicious pruning would prevent this tendency to throw up more than one stem. In other respects they do not require any pruning nor, after the first few years, any attention at all, except a little cleaning with a "parang." The trees are vigorous growers and have such thick foliage that they would soon cover the ground and effectually keep out all weeds and scrub.

Many methods have been suggested and tried for tapping the trees, but what may be called the herring-bone method appears to have advantages over the others. This is the way the Ipoh trees are tapped by the wild tribes of Perak, and it is also used by the Malays for tapping trees yielding bird-lime, etc. The American rubber collectors also adopt the same method for tapping Castilloa. In 1888-9 the trees, Para and Castilloa, at Kuala Kangsar, were tapped by herring-bone cuts by Malays.

On the 5th July a rubber tree in the Museum grounds was tapped by a herring-bone incision in the bark of the trunk about a quarter of an inch wide and reaching down to the wood. The cuts were widened several times to, ultimately, about half an inch. By the 7th October the cuts were closed up with a new growth of bark. Three months is therefore sufficient for the covering over of half inch wide cuts made right down to the wood. The last places to heal over were those where the two side cuts met the vertical one; here, of course, the width of exposed wood was considerably more than half an inch.

I would suggest that the lateral cuts should not meet the vertical ones at the same point, but that they should be made in the way shewn at *A* in place of *B*.



The junctions in *A* would heal over in much less time than in *B*, as they would not be nearly so wide.

The best way of carrying out the herring-bone method of tapping is a matter of much importance, as on it depends the cost of the collection of the rubber. Common knives, chisels, chopping knives, pruning knives, etc., are quite unsuited to the work, so I devised an implement for scoring the bark which apparently answers the purpose in a satisfactory manner. The handles are made like a boat-builder's draw knife, but the cutting blade is shaped like the letter **U**, and fixed by a suitable set screw or wedge in the bar joining the handles, and at right angles to them. In cutting a herring-bone incision the knife is taken in both hands by the handles and a long vertical cut made in the bark, but not so deep as to reach the sap layer. The blade ploughs out a furrow having the same section as itself, and of a depth corresponding to the inclination at which the instrument is held in relation to the surface of the bark; the set of the handles giving complete control over the direction of the blade.

The side cuts may then be made to the same depth. Having gone so far, and having cleaned away all the loose cuttings of outer bark, the receptical for catching the sap may be fixed at the lower end of the vertical score; and then beginning from the top of the cut it may, by a second application of the tool, be deepened to the proper extent. By following this procedure waste of rubber may be avoided to a large extent, and a cleaner product obtained.

The same instrument can, of course, be used to enlarge the scores for the subsequent tappings. The scoring knife will, I think, be found to quite halve the time taken in tapping the trees, and do the work in a much better fashion as well.

The recepticals for catching the sap can conveniently be made as follows:—A tin can is fitted with a sort of sharp straight-edged lip at one side, and a hinged lid to keep out fragments of bark, rain-water, etc., and it is best and quickest hung on to the tree by a couple of attached wires furnished with sharpened hook points.

In this way there is nothing required by the Collector but his scoring knife and tins. He wants neither nails, hammers, wet clay, knives, chisels or other things now in use.

Mr. J. C. Willis, Director of the Ceylon Royal Botanical Gardens, is trying a method of tapping with small detached

V-shaped incisions made with two cuts of a chisel having a wide blade of about an inch in breadth. These cuts, I find, heal up in a very short time and do little damage to the tree, but it is doubtful if they will yield as much rubber as the native herring-bone shaped cuts. Mr. Willis informs me his experiments are not yet complete.

Some years back an instrument for tapping was recommended, of the following description. A piece of wood, about an inch broad and a foot or more long, had the central portion set with sharp steel spikes like the hair of a brush. It was to be taken in both hands by the ends, which served as handles, and the spikes pressed into the bark, producing a series of punctures through to the wood. On trial, in Perak, on the Kuala Kangsar trees, it was found that although the sap flowed when it was applied in fair quantities it stopped almost at once, as the holes quickly became sealed up by the coagulation of the sap within them.

In Dr. G. Watt's *Dictionary of the Economic Products of India* the collection of the rubber is thus described:—

"Mr. Cross gives a detailed account of the method persued in Para, of which the following are the main facts. The milk is drained into small earthen vessels attached to the trees by an adhesive clay. The contents of fifteen of these cups make one English imperial pint. Arriving at a tree, the collector takes the axe in his right hand, and, striking in an upward direction as high as he can reach, makes a deep upward sloping cut across the trunk, which always goes through the bark and penetrates an inch or more into the wood. The cut is an inch in breadth. Frequently a small portion of the bark breaks off from the upper side, and occasionally a thin splinter of wood is also raised. Quickly stooping down he takes a cup, and pasting on a small quantity of a clay on the flat side, presses it to the trunk close beneath the cut. By this time the milk, which is of a dazzling whiteness, is beginning to exude, so that if requisite he so smooths the clay that it may trickle direct into the cup. At a distance of four or five inches, but at the same height, another is luted on, and so the process is continued until a row of cups encircles the tree at a height of about six feet from the ground. Tree after tree is treated in like manner, until the tapping required for the day is finished. This work should be concluded by nine or ten o'clock in the morning, because the milk continues to exude slowly from the cuts for three hours or perhaps longer, ... the quantity of milk that flows from each cut varies, but if it is large and has not been much tapped the

majority of the cups will be more than half full, or occasionally a few may be filled to the brim. But if the tree is much gnarled from tapping, whether it grows in the rich sludge of the "gapo" or dry land, many of the cups will be found to contain only about a tablespoonfull of milk and, sometimes, hardly that. On the following morning the operation is performed in the same way, only that the cuts or gashes beneath which the cups are placed are made from six to eight inches lower down the trunks than those of the previous day. Thus each day brings the cups gradually lower until the ground is reached. The collector then begins as high as he can reach, and descends as before, taking care, however, to make his cuts in separate places from those previously made. If the yield of milk from a tree is great, two rows of cups are put on at once, the one as high as can be reached and the other at the surface of the ground, and in the course of working the upper row descending daily six or eight inches, while the lower one ascends the same distance, both rows in a few days come together. When the produce of milk diminishes in long wrought trees, two or three cups are put on various parts of the trunk, where the bark is thickest. Although many of the trees of this class are large, the quantity of milk obtained is surprisingly little. This state of things is not the result of over-tapping, as some have suggested . . . . The best milk yielding tree I examined had the marks of twelve rows of cups which had been put on this season. The rows were only six inches apart, and in each row there were six cups, so that the total number of cups which had been made within the space of three months amounted to seventy-two."

In the *Kew Bulletin* of 1893, page 159, the following note occurs in relation to the yield of rubber:—

"Dr. Trimen to Royal Gardens, Kew. India rubber (21 lbs.) from *Hevea braziliensis* (Para) grown in Heneratgoda Botanic Gardens, Ceylon, in 1892.

"The tree from which this was obtained is now fifteen years old, and the stem has a circumference of 6 feet 5 inches at a yard above the ground. It has now been tapped three times, and has given the following yield:—

In 1888 it gave 1 lb. 11¾ ozs. 11 years old.
„ 1890 „ 2 „ 10 „ 13 „
„ 1892 „ 2 „ 13 „ 15 „

"Making a total of 7 pounds 2¾ ounces of dry rubber in five years.

"The tree is in no respect the worse for this treatment; the rest in alternate years permitting the scars on the trunk to become completely healed.

(*Signed*) HENRY TRIMEN."

Messrs. Hecht, Levis & Khan report the rubber to be worth 2*s.* 3*d.* to 2*s.* 6*d.* per pound.

It has recently been proved by Messrs. Curtis, Derry and others, that these trees will yield at least one pound per tree per year of clean rubber. Taking the value of the rubber at 2*s.* per pound only we get, for an acre of land, planted twenty by twenty feet, an annual crop worth £10 16*s.*, and if planted at fifteen by fifteen feet, worth £19 6*s.* This should begin, as far as is known, at about the sixth or seventh year, and by the twelfth year should have increased to double the amount given.

The history of the Ceara Rubber (*Manihot glaziovi*) in Perak is not encouraging. The trees were first planted in Perak in 1877, at Kuala Kangsar, and in 1880-1 at Lady Weld's Rest-house. They grew well for a few years, but on attaining a trunk diameter of about four to five inches all died off. Some were also planted in Taiping and other places with similar results.

A single tree of Castilloa Rubber was planted by Sir Hugh Low at Kuala Kangsar, on a low hill by the side of the Residency; it does not seem to thrive, but this may be due to the unsuitability of the situation.

I hope to be able to give further information on the subject when some experiments which are in progress are completed.

REPORT ON THE TAPPING OF THE PARA RUBBER TREES AT KUALA KANGSAR.

By R. Derry.

Some months ago the Director of Kew wrote to me that he had heard from Sir Hugh Low that the Kuala Kangsar tree did not exude when tapped, and asked, with a view to information, for the reason.

It will be seen from this report that the work for the year is not yet completed, and I would particularly point out that the experiments have not been conducted to test how much each tree would yield, for the reason that these trees are of much greater value to the Government at the present time as seed bearers than rubber producers; as an instance of this I would mention that applications for 70,000 seeds have been received for the current year (of which 25,000 have been supplied) and an application filed for 100,000 seeds next year.

The Para rubber trees (*Hevea braziliensis*) at Kuala Kangsar were first tapped during the month of August, and the work has been proceeding up to the present time. The frequent wet days have delayed the work considerably. At the end of October 60 trees had been tapped and 88 pounds of dry marketable rubber prepared. Most of the trees tapped were six years old, and from these trees an average of 10 ounces of dry rubber has been obtained. A few trees, twelve years old, produced 3 pounds each, but in no instance were the tappings exhaustive. Two samples have been sent to Mincing Lane for opinion and valuation.

TAPPING.

The trees were tapped with almost V-shaped cuts, a few inches apart, with a channel down the centre from the lower branches to the base. An ordinary pruning knife was used to make the first cuts, and about a quarter of an inch of the outer bark removed, care being taken not to cut too deeply. So soon as this commenced to callus, which varies from two to several days, the edges of the cuts were lightly shaved with a very sharp chisel every day, with an occasional interval, until the decided quantity had been exuded. The rubber was collected in locally

made tin boxes, 6 inches by 4 inches by 2 inches, nailed at the base of the tree, with the lid partially opened so as to prevent wet or dirt from falling in. When full this was allowed to dry, and the water pressed out (a pinch of salt appears to expedite the coagulation), and then kept in smoke for about a week to prevent mildew.

TIME OF TAPPING.

Para rubber has a short resting season, when most of the leaves fall off. The flowers usually appear first, and when the tree is in full foliage tapping can be commenced and carried on with different trees until again deciduous. The first cuts can be made at any time of the day, and may be left for weeks in the event of exceptionally wet weather, but the subsequent tappings should always be done in the evening as the rubber soon ceases to exude with the influence of the sun.

PLANTING.

Most of the trees at Kuala Kangsar are planted on wet land, subject to be flooded every year. Some, however, are on high dry land, but my experiments are not sufficiently complete to say if there is any difference in the yield of rubber on dry against wet land.

The tree appears to be the most adaptable of any rubber tree, growing from swampy lands to an elevation of several hundred feet, and seems to thrive on any ordinary soil. The material point in its cultivation is close planting. I recommend not more than fifteen feet apart.

REMARKS.

I am of opinion that a tree five or six years old is capable of producing $1\frac{1}{4}$ pounds, and a tree thirteen years old, 5 pounds of rubber without injury. The cost of tapping, drying, and preparing I should estimate, working on a large scale, about 30 cents per pound. The present London value for dry rubber is from 3*s*. 6*d*. to 3*s*. 8*d*. (sterling) per pound.

I would add that I shall be able to offer some further remarks when my experiments are completed, and when I receive an opinion on the samples sent home.

CORRESPONDENCE RELATING TO THE INTRODUCTION OF RAMIE CULTIVATION INTO PERAK.

(British Resident, to Curator of the Perak Museum.)

British Residency, Perak,

28*th November*, 1896.

Dear Wray,

You have probably seen a copy of this,* and have of course kept yourself abreast of the latest that has been written about rhea and ramie. Can you favour the Government with an official memorandum on the subject? What kind we have here, whether indigenous, its value, what used for locally, prospects of native cultivation and exportation of dried ribbons, prospects of European planters and preparation on the spot, soil, suitable seasons, methods, and the points which you may think it will be for the good of the State to make public in English or in Malay . . . . In the Secretary to Government's Office there is a copy of an Indian Agricultural Ledger on the subject, which I will have sent to you, but I do not think it is much up to date.

Yours sincerely,

L. Wray, Jun., (*Signed*) W. H. Treacher.

Perak Museum.

(Curator, Perak Museum, to British Resident.)

Taiping, Perak,

20*th December*, 1896.

Dear Mr. Treacher,

I have hunted up all the information I can on the subject of ramie, and have come to the conclusion that planting it in Perak would not pay. I enclose a part of my notes for you to read, and should like to know what you think had better be done in the matter. It is taking a great responsibility to recommend planters to cultivate a product which, according to the information now available, is not likely to cover expenses. On the other hand the information may be incorrect, and therefore it is inadvisable to prevent anyone from trying experiments in the cultivation.

Yours truly,

W. H. Treacher, Esq., c.m.g., (*Signed*) L. Wray, Jun.

The Residency, Taiping.

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* The book was "*Rhea, its Cultivation, Decortication and Baling, and the subsequent Treatment of the Ribbons by the 'Gomess' process,*" compiled under the direction of the Rhea Fibre Treatment Company, Limited, by B. Ribbentrop, Inspector-General of Forests, India. This book advocates the production of ribbon by planters for sale to the Gomess Company. The cost of cultivation is estimated £4 and the selling price in the East at £7 per ton of ribbon.

REPORT ON THE PROSPECTS OF RAMIE CULTIVATION IN PERAK.

The possibility of the successful cultivation of ramie depends on (*a*) Suitability of climate and soil, (*b*) Cost of production, and (*c*) Price obtainable for the product.

In regard to the first condition, there appears to be no question that the climate is eminently suited to ramie, and that there is an abundance of land fit for its growth.

The cost of production therefore resolves itself into a question of the cost of the labour necessary to produce a given quantity of the fibre.

Mr. J. Forbes Royle, in *The Fibrous Plants of India*, gives the yield at about 12 maunds of fibre per acre. This would equal, at 80 pounds per maund, 960 pounds.

Mr. J. Montgomery, in a report to the Indian Government, gives the yield per acre as 972 pounds, but with proper cultivation, he says, 1,000 may be obtained.

Mr. Hardy is stated to have said, in *Rhea, its Cultivation, etc.*, that a yield of 1,400 to 2,800 of ribbon per year per acre may be obtained; this would give, of fibre, about 840 to 1,680 pounds.

"E.M.," in the *British North Borneo Herald* puts the yield at from 500 to 1,120 pounds to the acre per annum.

Mr. E. Mathieu, in the *Straits Times*, gives the production, under good cultivation, at 30,000 pounds of stems, yielding 6 per cent of fibre; this equals ·84 of a ton, or 1,881 pounds.

I will now put the above information into a tabular form, so that it may be easier to draw deductions from it:—

	Fibre. lbs.	Ribbon. lbs.
Forbes Boyle	960	1,280
J. Montgomery (mean) ...	986	1,314
Hardy do. ...	1,260	2,100
E.M. do. ...	810	1,080
E. Mathieu do. ...	1,881	2,508
Mean yield per acre	1,173	1,656

The mean yield of fibre is therefore a few pounds over half a ton, and of ribbon ·739 of a ton per acre; that is about $14\frac{3}{4}$ hundredweights, or $12\frac{1}{2}$ pikuls.

Very little is to be found in any of the accounts of ramie of the cost of the cultivation. It is variously stated that one coolie can keep in order two to three acres of land. While no information is available as to the cost of gathering, boiling, stripping, drying and baling the ribbon.

Taking the mean, that is one coolie to $2\frac{1}{2}$ acres of land, or two coolies to 5 acres, and the wages at $9 per month, the cost per annum is $43.20 per acre, and per ton of ungathered ribbon $58.45.

As I have already said there is nothing on which to base an estimate of the cost of the harvesting and preparing the crop. The process is as follows:—

The stalks are cut near the ground, then stripped of leaves and topped, they are then carried to the boiling tanks and boiled for about a quarter of an hour; the bark is then stripped off by hand, carried to the works to dry, when quite dry it is sorted into lengths, and baled ready for shipment.

Considering that some 15 tons of stalks have to be treated per ton of ribbon, I do not think that less than $20 could be allowed per ton of ribbon. This would bring up the cost of the ribbon to $78.45 per ton, or $57.98 per acre.

There is then supervision, manure, rent, duty, and buildings. The least that can be allowed for this is $10 per acre per year. Taking a 500 acre estate this would be made up as follows:—

	$
Rent, at 50 cents per acre	250
Supervision, at $300 per month ...	3,600
Manure	500
Upkeep of Buildings	250
Duty on 369·5 tons at $2\frac{1}{2}$ per cent ...	623
	5,223

The final cost of the ribbon would be $91.97 per ton, or $67.98 per acre.

The next part of the subject is (*c*) the selling price of the ribbon. In the handbook of the Rhea Treatment Company it is

stated "The owners of the 'Gomess' process, who are represented in England by the Foreign and Colonial Rhea Fibre Treatment Syndicate, Limited, 17, Shaftesbury Avenue, London, W., and in this country (India) by the Indian Rhea Fibre Parent Company, Limited, Bombay, are prepared to contract for the purchase of large quantities of dried ribbons of bark; and in regard to this the London Syndicate report:—

(*a*). "That they require the raw material in the shape of ribbons, that is the whole bark hand stripped from the stems, thoroughly dried and packed in bales.

(*b*). "That they prefer the species *Boehmeria nivea*, but that they can also use the *Boehmeria tenacissima* and Banrhea.

(*c*). "That the quantities required by the London Syndicate would be continuous, and very large; that it would be difficult to give exact figures, but that they could do with 10,000 tons to commence with.

(*d*). "That they are at present prepared to contract, at prices equivalent to from £10 to £11 per ton delivered in London, or £7 a ton at port of shipment in India."

These prices are equal in dollars, at an exchange of 2*s.* 1*d.*, to $96 to $105.60 per ton in London, and $67.20 per ton, or $4 per pikul, at port of shipment in India or, presumably, in the Straits.

Dr. D. Morris, the Assistant Director of the Royal Gardens, Kew, in a lecture delivered on the 30th November, 1896, gives the price of ribbon as £8 per ton in London.

It does not appear that more than £7 ($67.20) per ton could be reckoned on for the ribbon, and as by the above estimate it would cost to grow and prepare $91.97 per ton, it would appear that there is a loss of $24.77 per ton, or $18.30 for each acre of cultivation.

Dr. Morris, in the *Kew Bulletin*, says—"It is important therefore for ramie planters to aim at the production of ribbons at a cost not exceeding about £4 to £5 at the port of shipment. Important elements in such production would be to plant ramie only in places where the soil and climate will allow of three or four crops to be reaped per annum; where labour is very cheap and abundant, and where good facilities exist for transport and shipment." It is just in the one matter of labour that Perak does not come up to the requirements of the case. Labour here is very dear and scarce. If it was to be had for $4.50

per month there is no reason why ramie culture should not be successful.

There is another side to this question, and that is for the planter to also be the manufacturer of the finished product, in the same way as sugar planters are; but there is at present absolutely no information published from which any estimate could be made as to the cost of manufacture. Every detail would have to be worked out by the planter himself: firstly, in regard to processes and, secondly, as to the machinery which would turn out the fibre in the form most easily saleable to the spinners at home.

(*Signed*) L. WRAY, JUN.

5th January, 1897.

(*The British Resident, to the Resident-General.*)

RESIDENT-GENERAL,—

You may like to see this. Please return it to me.

2. It is disappointing. I had hoped that ramie cultivation might prove a success here, but according to Mr. Wray's estimate there would be a loss of $18.30 per acre at present prices.

(*Signed*) W. H. TREACHER.

6th January, 1897.

In the mean time Mr. E. Mathieu addressed the following letter to the Resident-General:—

SIGLAP ESTATE, SINGAPORE,

15th December, 1896.

TO F. A. SWETTENHAM, ESQ.,

RESIDENT-GENERAL OF THE PROTECTED STATES,

SIR, KUALA LUMPUR.

I have the honour to beg your acceptance of the accompanying brochure on *Facts about Ramie*, a re-issue of contributions by Mr. Ridley and myself to the *Straits Times*.

A letter of Messrs. Dunlop Bros. & Co., 49, Fenchurch Street, London, to the Government of Jamaica says, under date June 15th, 1896—"Since we last wrote to you the demand for ramie has considerably increased. Not so much in a speculative manner as in a steady, firm demand brought about by manufacturers in a large way of business who require constant supplies of the article to meet certain demands which have arisen for a class of material that could really only be made from rhea fibre. Nor it is likely that this demand will only be spasmodic, because it arises from the efforts of the English manufacturers to compete with cheap artificial silk, which is being made and sold in this country

from France, etc." The demand for ramie fibre having assumed such a character of fixity and continuity it seems hardly likely that it will long remain unanswered, and that the attention of planters will not soon be drawn to it.

The want of an efficient decorticator to produce clean fibre (instead of ribbons) has been hitherto a stumbling-block in the way of planters, but from information recently received I am led to believe and, almost state with certainty, that the "Faure" decorticator and a still more recently invented machine, the "Estienne" machine, of which I have received full particulars and drawings, entirely remove the difficulty. The latter, which has only just undergone a public trial in Paris with signal success, is not yet on sale.

I believe that a great opening lays before Malaya as a ramie producer, and if, in your enlightened sympathy with this object, your Excellency sees a way to promote its development, I shall be glad to assist in any way I can.

I have already written to the makers of these new machines asking them to send each one machine for a public trial, but it is a far cry from here to Paris and, given the little the people know or care about Malaya, it is not easy to induce them to such a step; may be the action of Government would have much effect in such a matter.

I have the honour to be,

Sir,

Yours faithfully,

(*Signed*) E. MATHIEU,

Manager of Siglap Estate, Singapore.

(*Resident-General, to British Resident, Perak.*)

Why not send a copy of Mr. Wray's report to Mr. Mathieu, and ask him whether he agrees with it?

23*rd January*, 1897. (*Signed*) F. A. SWETTENHAM.

CURATOR AND STATE GEOLOGIST,

Will you please see this. I am travelling and cannot well get a copy of your report. Would you be good enough to send a copy yourself to Mr. Mathieu. A clerk in the Secretary to Government's Office would copy your report if you have not a spare copy.

2. In view of your report I do not see my way to recommend any action by Government, except perhaps in the way of granting land on special conditions.

IPOH, 27*th January*, 1897. (*Signed*) W. H. TREACHER.

SIGLAP ESTATE, SINGAPORE,
15*th March*, 1897.

L. WRAY, JUN., ESQ., PERAK.

DEAR SIR,

I beg to acknowledge the receipt of your letter of 10th instant enclosing a report on the prospects of ramie cultivation in Perak, which I have read with great interest, and as you invite observations on the subject, I now venture to state my views.

This country being the native habitat of ramie (*Boehmeria tenacissima*) the question of suitability of climate and soil may be considered as answered.

You, therefore, rightly say that the question resolves itself between cost of production and value of the staple in London.

To narrow the question still further, let us classify exactly the staple which we have to deal with, for, in ramie, confusion of terms leads to endless misapprehension. Ramie, up to the present, has reached Europe in two forms,—first, ribbons, second, China-grass, the hand scraped Chinese staple. Ribbons are the fibrous bark, free of the inner wood, but with the gum and the outside pellicle on. They may be produced either by hand stripping or by machines which split the stems open and eject the inner wood, these machines should be called delignators, not decorticators, for they leave the cortex untouched. According to the quality of the work of the machine these ribbons give from 35 to 40 per cent of their weight in dry, de-gummed filasse; the dead weight of useless matter ranges between 60 to 65 per cent. China-grass gives from 65 to 70 per cent of its weight in dry, de-gummed filasse; the dead weight of useless matter ranges between 30 to 35 per cent.

Kindly consider how this works out. But previously please bear in mind that weight for weight China-grass occupies only 50 per cent of the space that ribbons do. Taking a de-gumming kier of a given capacity it will only contain half the weight of ribbons to a given weight of China-grass. Supposing then, a kier of a sufficient capacity to receive one ton weight of China-grass, the same kier will receive only half a ton of ribbons. If, therefore, you put in the ungumming kier one ton of China-grass you will lose, as stated above, one half, or 750 pounds in weight; and the weight of dry de-gummed fibre obtained will be 1,490 pounds. If you fill the same kier with ribbons you can only get in half a ton, or 1,120 pounds of ribbons, on which you lose two thirds, or 746 pounds; the weight of dry degummed fibre obtained being 374 pounds. Note, that in the two cases the amount of solvent employed must be the same or, if anything, stronger in the case of ribbons. From repeated experiments in France and in England the cost of de-gumming one ton of China-grass has been found to be about $40 (£4) per ton, or, allowing one third loss of weight, $53 per ton of the de-gummed product. What cost $40 on one ton of China-grass will cost (owing to difference of weight for same volume) $80 per ton on ribbons, and allowing two-thirds loss of weight, $240 per ton of the de-gummed product.

There lies the condemnation of ribbons, and the situation is hopeless, because between the planter and the spinner there stands, of necessity, a third party, *viz.*, the de-gummer.

This third party is the patent holder of this or that process, either a mechanical and chemical process combined, or simply a chemical process such as the "Gomess" process, and as long as ramie must pass through his hands before reaching the spinner the latter will have nothing to do with it, because, first, the price he puts on it is preclusive and, secondly, the fibre produced has not infrequently been irretrievably damaged when coming out of the de-gummers' hands, the damage shewing itself only after the weaving into fabrics. A still greater impediment is the fact that this position of go-between creates, in favour of the de-gummers, a monopoly which the spinners are not likely to suffer: for, among these various de-gumming concerns there are many, especially in France, who have no backbone at all, they turn out and shew you some beautiful pearly white fibres as their product; they offer to pass contracts for thousands of tons, but, were these contracts taken seriously I have no doubt that, in many cases, as ten years ago in Algeria, history would repeat itself, and when the time came to take delivery of the stems, they would find means to back out of their bargains. I do not say that some of them are not well meaning but their main aim is the raising of money on processes, or selling patent rights. But *caveat emptor!*

As a correspondent of mine, an acknowledged European authority on the subject, puts it, in a recent letter — "Il n'existe pas, en France, de dé-gommeurs de ramie, il n'existe que des dé-gommeurs de capitaux, qui prètendent acheter des cultivateurs, et n'achètent jamais."

Ribbons are condemned and we have, I think, heard the last of them; the spinners will not look at them, and the planter who "goes in" for ribbons must therefore put himself in the hands of the de-gummers, and there he will never find more than £8 to £9 per ton for his product. This, as Dr. Morris points out, means £4 to £5 at the port of shipment; but that is simply an economic impossibility, and when Dr. Morris suggests it I can only conclude, notwithstanding the authority of his name, that he has not grasped the practical sides of the question, for you come only near the truth in your report when you say — "I do not think that less than $20 could be allowed per ton of ribbons." You might have gone a good deal further, and I venture to think that if you picture to yourself what it is to turn out one ton of ribbons according to the process referred to you will find it an utter impossibility.

Kindly allow me to try and draw it out. The yield of dry ribbons is on average 7½ per cent of the weight of green stems without leaves. To produce one ton of dry ribbons it will therefore require about 30,000 pounds of green stems, and taking an average of six stems (stripped of leaves) to the pound, we shall have to deal with 180,000 stems. You have first to strip the leaves, then to boil 180,000 stems, then take them out boiling hot, strip them while hot (or else the gum hardens again) of their bark. "The boiling," say the patentees, "will take a quarter of an hour," I give them four days to do it in, with two men, and then it will not be done. I say nothing of the size of baths required for such an operation, the appliances necessary, cranes, travelling baskets, etc., to manipulate the hot stuff; in fact it is a manifest impossibility. But that will not prevent the patentees from holding to their point, and that in good faith, for they have done it on a dozen stems or so in a tub.

The bane of ramie is that most of these inventors are Parisian or Cockney cultivators, and they base the whole fabric of the ramie industry on ready made notions sprung out of their own heads without the slightest regard for the material stubborness of a fact.

Now, Sir, I hope I have succeeded in making this much clear, first, the economic production of ribbons is an impossibility, second, if they could be economically produced there is no outlet for them.

The question may now be narrowed to this. Can clean, dry, partially de-gummed fibre, ready for the spinner, be produced in Malaya at a cost not exceeding say $180 per ton delivered in London, and find a market in London at the same price as China-grass, *viz.*, £32 to £35 per ton. And to this question I answer—In a suitable locality (on a river) clean, dry, de-gummed fibre equal to China-grass can be produced in Malaya for about $150, and put in London at a total cost of $180, or thereabouts. In support of this statement, I beg to send you, under separate cover, an estimate of costs and returns of a 500 acre ramie estate.

This estimate, of which only fifty copies have been printed, has just come to my hands from the printers. It is for private circulation only, and I sell it at $100 a copy. You are welcome to consult it, and return it to me when done with, unless Government feel sufficiently interested in the matter to take it. As far as I know, no such work has ever yet been attempted, the nearest approach to it being a Mexican document wholly unreliable and incomplete.

You will see that the scale of wages is put down at $6 per month, but that is with the proviso, expressly stated in the introduction, that all work should be organised on the contract system, as in Deli. If you examine the sums allowed for the different items of work, you will find (supposing an average good soil and sufficiently pulverulent), I think, that all my figures are high: draining, "changkoling," etc., afford a margin which allows the diligent coolie to increase his days earnings by one-third. Again, in the decorticating mill (*vide* Faure's prospectus) two mens' output on one machine should be from 160 to 200 pounds of dry fibre per day. I pay them in the estimate 50 cents per hundredweight, so that if they turn out say 180 pounds their earnings are 80 cents, or 40 cents each per day. Second, with the estimate you will find Faure's propectus. I am unable to send you samples of the fibre as it comes out of the machine, as I require them to answer enquiries from other quarters. I have received these samples from Jamaica, from London, Lemoges and Sumatra, where one machine was at work some time ago. A new one has just arrived by last French mail, and I have been asked to see it at work when the time comes. The maker is quite disposed to send me one to make a public trial, but even if I should order it out I have no ramie to feed it with, and there is none to be had.

Not being able to shew you the fibre as it comes out of the machine, I must ask you to take my word for this, that it not only delignates perfectly (*i.e.*, takes out the inner wood) but also decorticates (*i.e.*, rubs off the pellicle) and leaves nothing but the fibre in just the same state of division as the China-grass; but you must bear in mind that China-grass comes to Europe after soaking in hot water with ashes, which does away with the slightly greenish colour of the fibre when wet.

We have got in the "Faure" machine a tool which actually turns out, for half a cent per pound (labour cost) a produce equal to China-grass of a value of £30 to £32 per ton.

The question is now can we reach the spinner with this product? Not yet. He does not even allow China-grass to reach him, precisely, always, on account of the gum. We, therefore, have to ungum our fibre, or at least partially ungum it, and here I give you an extract from a letter

recently received from Mr. Barraclough, Textile Engineer, 20 Bucklersbury, London.

"Many of the leading spinners and people who desire to become spinners of ramie, are personally well known to me; some of them intimately, and it will not be a difficult matter for me to make contracts for large quantities as soon as you and your friends are in a position to fulfil them. One of my friends, who ranks amongst the largest spinners of flax and hemp in the world, has several times told me recently that he is prepared to buy the fillasse produced by Faure's machine in its de-gummed state, not bleached, to the extent of thousands of tons per year, and is ready with his signature to a contract as soon as he finds good practical people to fulfil it. In the meantime, I venture to say that you would be rendering a good service to the cultivators of ramie if you were to free the ground from fear of difficulties in relation to de-gumming, and to let every cultivator of ramie know that he can be absolutely independent of all de-gumming patents. The process is a very simple one, and the question of chemicals is almost eliminated," etc., etc. Follows an estimate of a plant, machinery and process, to de-gum one ton a day.

Now, Sir, I think I can conclude—

First.—We can produce China-grass by purely mechanical means at a labour cost (which does not include cost of power employed) of half a cent per pound.

Second.—The de-gumming, which may offer certain difficulties (much exaggerated by patent holders) in Europe, because the gum is hard, is, to us, dealing, as we do, with freshly cut stems, a mere bugbear, and it need not cost 1½ cents a pound to do it, but on the condition that the steeping takes place immediately after decortication. Boiling at simply boiling point will be sufficient for young, juicy stems, but on the very mature stems, when the gum is thick, boiling under pressure (about 45 pounds to the square inch) will perhaps be necessary, and the addition of 2 to 3 per cent of washing soda will be useful, but that is all included in the cost of 1½ cents given above. By means of pressure it will be easy to obtain a complete ungumming, and it may be to the advantage of the planter to lay out a complete ungumming plant with autoclave kiers, for, of course, the purer the fibre, the freer from gum, the higher its value, which would then reach £40 to £42 per ton.

Third.—We can send our fibre straight to the spinners' door; and the moment this is done the demand will spring up to unforeseen figures. I beg to state, for fear of being misunderstood, that I am not pecuniarily interested for one cent in the "Faure" machine, and that should I hear of a better machine coming forward I would certainly recognise it, as my ambition lies not in selling machines but in starting ramie cultivation in these countries, whenever I am able to do so.

And I shall now conclude. Ramie is sure of a brilliant success in Malaya, under suitable conditions, if put in the hands of men who have thoroughly mastered the question in all its bearings; otherwise it will bring nothing but disaster.

I remain, Dear Sir,

Yours faithfully,

(*Signed*) E. MATHIEU.

P.S.—I am quite agreeable to your publishing this letter if you think it desirable.

SIGLAP ESTATE, SINGAPORE,
17*th March*, 1897.

DEAR SIR,

To put in bolder relief the absurdity of the process of working ramie which I attempted to draw out in my yesterday's letter I should have put it under figures, and I beg to do so now, because the advocacy of such processes has consequences which may do an immense deal of harm to the cause of ramie. Several natives round about Singapore, allured by their simplicity (?) have started ramie planting on a small scale up to two acres or so, and have come to me, asking me how to dispose of their crops when they mature. I point out to them the utter folly of the attempt, but the harm is done. I have long ago made these objections to people at home, but if I have had a reply, which has not often been the case, it has been a snubbing. It is important then, to point out to natives that ramie cannot be worked on these lines, that their time will only come when large estates open up and set up their machines; then they may probably find a market for their stems, and this is my object in putting the operation under figures. One ton of ribbons, as shewn, requires 180,000 stems.

	$	c.
Cutting, stripping the leaves, and bundling for cartage, 180,000 stems at 5,000 stems per day of 25 cents ...	9	00
Cartage, 15 to 18 tons of stems	6	00
Boiling (as only a tank of the dimensions of Charing Cross Baths could contain 180,000 stems, the boiling must be done in lots of say 10,000 at a time, in tanks of at least 10 tons capacity, which means 18 tanks, or 18 boilings in one tank).		
Filling in one tank with water, (two men at 25 cents, 50 cents,) 18 tanks	9	00
Emptying (one tank, one man, half a day, 13⅓ cents) 18 tanks	2	25
Putting in 10,000 stems (one man at 25 cents) 18 tanks	4	50
One Fireman, and Firewood	1	00
Taking out 10,000 stems hot (two men at 25 cents) 18 tanks	9	00
Stripping 180,000 stems, at 150 stems per hour, or 1,500 per day of 25 cents	30	00
Spreading to dry, and drying (a very delicate and difficult operation)	9	00
Straightening the ribbons, and bundling them	2	50
Packing and baling one ton	2	50
Freight (ribbons cannot be pressed, and they bulk largely) per ton to London	15	00
	109	75
Cost of cultivation and management, rent, etc., on a little less than one acre, minimum	40	00
Cost of, in London, per ton of ribbons ...	149	75

This makes no provision for building of tanks, indispensable machinery, sheds, etc.

I am, Dear Sir,

Yours faithfully,

L. WRAY, JUN. ESQ., PERAK.

(*Signed*) E. MATHIEU.

(*Curator, Perak Museum, to the British Resident.*)

TAIPING, PERAK,

SIR, 25*th March*, 1897.

I have the honour to enclose two letters which I have received from Mr. E. Mathieu.

2. You will see that he agrees with me that it would be unwise to recommend natives or others to plant ramie with the idea of selling the ribbon as advised in the book you sent me by Mr. B. Ribbentrop.

3. In regard to the other side of the question, that is the production of the finished product by the planter, Mr. Mathieu's estimate is based on a lower rate of wages than rule in Perak, and even then it requires the production of half a ton of the cleaned fibre per acre per year to cover expenses.

4. A Mr. Bluntschli was here the other day. He is the Manager of a ramie estate in Deli, where they have planted 10 acres of the plant, and where they are going to try the "Faure" machine. He, however, could not tell me anything as to the yield per acre. He came here to look for land for this purpose, and I gave him the rainfall returns, which for this cultivation are much more suitable than those of Deli. He believes it will be successful in a suitable climate like Larut, but admits that everything has to be worked out and proved.

5. I am of opinion that if the Government wishes to help in the introduction of this culture the best thing to do is to plant up, in a carefully selected spot, a small area of ramie, and collect statistics as to yield, management of crop, etc.

I have the honour to be,

Sir,

Your obedient Servant,

THE BRITISH RESIDENT, PERAK. (*Signed*) L. WRAY, JUN.

(*Curator, Perak Museum, to Mr. E. Mathieu.*)

TAIPING, PERAK,

DEAR SIR, 5*th April*, 1897.

I have the honour to acknowledge, with thanks, the very interesting letter you have been good enough to write on the subject of ramie. I am glad to see that you agree with me that the production of ribbon at £7 or £8 per ton is an impossibility in the Straits.

The question that was put to me was whether the Government should advise and encourage natives and others to plant ramie with the idea of selling the ribbon to the Gomess and other Companies, who have been offering to buy it, at £7 to £8 per ton. I wrote to the British Resident, under date the 20th December, 1896—"It is taking a great responsibility to recommend planters to cultivate a product which, according to the information now available, is not likely to pay expenses," I now see by your letter of the 17th instant that natives have been advised in Singapore to plant ramie, with unfortunate results.

Many thanks for your estimate which, however, I have already read. I now return it to you. I think the labour is put at too low a figure for Perak. A Kling expects to get at least $9 per month, and a Chinaman from $10 to $12. You see the wages paid in the mines are very high, and the hours only about two-thirds of those on an estate.

According to your estimate it requires practically half a ton of clean fibre per acre per annum to cover the expenses of working the 500 acre estate. I fancy that, as yet, we have no data to go by in this part of the world as to the yield, and that the first thing that should be done by anyone interested in the culture is to plant up a small area and get accurate information as to what is the actual yield of fibre per acre before investing or recommending others to invest, large sums in starting the cultivation on an extensive scale. I have ventured to recommend that the Government should take up this work in Perak, as it seems to be the best way in which help can be given to those who are contemplating going into ramie cultivation.

I am Dear Sir,

Yours truly,

E. Mathieu, Esq., (*Signed*) L. Wray, Jun.

Singapore.

(*Mr. E. Mathieu, to the Curator, Perak Museum.*)

Siglap Estate, Singapore.

Dear Sir, *7th April*, 1897.

I beg to confirm my letter of the 15th ultimo and, judging by your able report that you take a genuine interest in the question, I venture to send you a sample of ramie fibre as it comes out of the "Faure" machine, and as I received it by yesterday's mail from Mr. Th. Barraclough, London. It is accompanied by the following letter:—

"In reply to your letter of the 6th February, I send you a sample of fibre in exactly the state in which it left the "Faure" machine. I was present several days at the running of the machine last October, on Mr. Faure's estate in France.

"The machine was placed alongside the plantation, worked by a small portable engine, and the stems were brought to it. After the fibre was extracted it was hung over poles to dry in the open air, and the sample I send you is some of the fibre which was then extracted.

"The machine fibre is worth, to-day, in this market, £32 per ton, less 2½ per cent. It ranks with the best China-grass grown in a particular province of China, and eagerly bought up by a German manufacturer, which may be called "Best Best China-grass," and which is to-day worth

per ton £35. That same manufacturer has valued my sample at £32 per ton, so you may take this figure as quite authoritative.

"I do not advocate the extraction of the whole of the gum at the place of growth. It is better not to overdo it and leave a few per cent, say 5 to 6 per cent of the gum in the fibre, to be removed by the manufacturer when he puts the fibre through the softening process as a preliminary to the combing and spinning.

"With regard to the cost of producing the fibre, that, as you are well aware, varies according to circumstances. As a man of practical knowledge and common sense ideas in relation to this matter, you are fully aware that the cost of growing and decorticating ramie must, of necessity vary, according to the place and circumstances, but calculating everything very liberally indeed, I am of opinion that ramie can easily be produced at £14 per ton of dry fibre exactly like the sample enclosed, and I have no doubt that under certain favourable circumstances the price can be reduced to £12 per ton. I add, for the expense of packing, shipping to London, Agents' commission, a round sum of £5 per ton, which is liberal, and the figures at present before me are that a fibre costing net here £19 per ton will easily fetch £32, less 2½ per cent, in this market.

"Referring to my to-day's sample, whatever you do with fibre in that state causes it to weigh less, and to fetch a higher price in this market. Supposing you were to partially de-gum it and were to take, out the gum—equal to 20 per cent of its weight, this would immediately raise the price to about £39 per ton. The cost of de-gumming, say £3 per ton, would raise the price to £42 per ton. The fibre in that condition would fetch here from £48 to £56 per ton, depending largely on the mode of de-gumming. You would also have an additional profit from saving of freight."

I remain, Dear Sir,

Yours faithfully,

(*Signed*) E. MATHIEU.

SIGLAP ESTATE, SINGAPORE,

L. WRAY, JUN. ESQ., 12*th April*, 1898.

PERAK MUSEUM.

DEAR SIR,

I beg to acknowledge the receipt of your letter of 5th instant, which reached me just after mine dated 7th had left me.

Regarding the sample of fibre which I sent you, I had it in my mind, but somehow forgot, to refer to a statement of Dr. Morris in his Travers lecture on the 30th November last.

He is reported to have said—"Crops weighing 15 to 20 tons can be produced per acre in a year. This quantity would yield ribbands or raw fibre of the present value of £8, or *filasse the finished fibre worth about £14 per ton.*"

It is on the words in italics I wish to draw your attention. The words "filasse" or "finished" fibre would convey to any clear minded person the idea of a fibre ready for spinning, and if such a product were worth only £14 per ton, well, that would settle once and for all the

question of ramie. As a matter of fact, however, the really finished fibre, ready for spinning is worth, unbleached, but de-gummed, about £50 per ton. The best China-grass, worth £35, is not a finished fibre; it contains at least 25 per cent of gum, which has to be eliminated before it can be termed "finished." £14 is not even the price of jute from India.

Now, this is one instance out of hundreds of the way in which the question of ramie is handled. From beginning to end you came across these indefinite and irregular terms, which naturally breed confusion and give the whole thing a character of unreality and untrustworthiness very difficult to overcome.

There is no reason why this should be, and after a long study of ramie, extending over some years, I have come to the conclusion that ramie will impose itself if only words and terms are agreed to which will fit exactly its different stages. "La science est une langue bien faite" say the French; ramie is a case in point, our knowledge of it is confused and uncertain because our language, in connection with it, is loose and inexact.

This said, allow me to revert to a passage of your letter—"I fancy that as yet we have no data to go by in this part of the world as to the yield, etc."

This is true, I believe, of the Malay Peninsula, where no attempt has ever yet been made to cultivate ramie, but there exist very positive data as regards Java.

I think it was Dr. Blume, the author of *Flora Javāē*, who, after careful experiment, gave the following conclusions—

"Planting from root cuttings four crops are obtained in Java annually; the first year the plant yields 4 stems at the first cutting; 6 to 8 at the second cutting; 10 to 12 at the third; 16 to 20 at the fourth cutting."

"One bouw (7,096 square metres) produces 34,000 kilogrammes of green stems without leaves and topped (the head bud cut off), which give 1,020 kilogrammes of dry filasse."

Taking the bouw at $1\frac{3}{4}$ acres, and working out these figures we find:

$1\frac{3}{4}$ acres = 34,000 kilos green stems, stripped of leaves = 1,020 kilos dry filasse.

$1\frac{3}{4}$ acres = 74,900 pounds green stems, stripped of leaves = 2,246 pounds dry filasse.

1 acre = 42,800 pounds green stems, stripped of leaves = 1,280 pounds dry filasse.

Kindly observe that the figure of dry filasse, 1,280 pounds, represents only 3 per cent of the weight of green stems stripped, so that it must be taken as that of filasse completely decorticated, dried and partially ungummed, which means a fibre of enhanced value.

You will find that these figures tally pretty closely with my estimate, and I seize this opportunity to state that the figures which I have put down in my estimate are not haphazard figures but figures which I have mostly obtained from direct sources.

It must be remembered that ramie cultivation is no new thing; in Algeria ten years ago it was extensively planted, not in large estates, it is true, but estates of sufficient sizes to afford quite reliable data, 30 to 40 acres for instance: these were worked for two and, in a few cases, three years, and given up in disgust when the parties who had contracted to buy the fibre backed out of their contracts. In Mexico, Cuba, Central America, large fibre producers (Sisal hemp) estates were opened up six years ago, and in one case 100 acres planted, but when crop time came the machine used failed to do the work.

It is given to any one who has planted ramie, even *en petit*, to discriminate between the garbled reports of interested parties and the well-controlled figures of such experiments as Mr. Fawcett's in Jamaica, or Consul Hosies' in Tamsui (Formosa) or Dr. Blume in Java.

That no trial has been made in Malaya is a misfortune, but there is *prima facie* evidence that, given suitable conditions, these recorded figures will be fully maintained and, probably, exceeded.

I did doubt, in the part, the ability of ramie to pay its way, and these doubts were only cleared when the new model of Faure's machine appeared, but I never doubted the capacity of ramie to yield in Malaya paying crops if the fibre could but be economically extracted. My own experiments, Mr. Allen's seven acres of ramie near Changi (Singapore), Mr. Bluntschli's Paya Nibong Estate in Deli, leave no doubt on this point. I have therefore the fullest belief in the ultimate success of ramie in the Native States, and I am confident that my estimate of yield will prove below the truth. At the same time it will be well to remember that if ramie is not to be weighed down by initial expenses it must be undertaken on a pretty large scale. If due allowance is made for this in the tentative experiments which may be made in your parts I have no fear of the results.

Yours faithfully,

(*Signed*) E. MATHIEU.

(*Curator, Perak Museum, to Mr. E. Mathieu.*)

PERAK MUSEUM, TAIPING,

DEAR SIR, 13*th April*, 1897.

I have to acknowledge with thanks the sample of ramie fibre prepared by the "Faure" machine, which you have been kind enough to send me with your letter of the 6th instant.

The fibre is certainly very nice, and if the machine can turn out similar stuff in the large way on an estate I should think it will prove a valuable machine.

I have forwarded the sample to the British Resident, and afterwards will place it in the Museum along with the other ramie specimens.

Again thanking you for the sample.

I am,

Yours truly,

(*Signed*) L. WRAY, JUN.

E. MATHIEU, ESQ.,
SIGLAP ESTATE, SINGAPORE.

(*British Resident, to Curator, Perak Museum.*)

BRITISH RESIDENCY, PERAK,
20TH APRIL, 1897.

MY DEAR WRAY,

I am much obliged to you for all the trouble you have taken about ramie. I do not see that Government can do anything to help in the way of making an experiment here. The experiment would have to be most carefully carried out, and we have no one available to look after it.

Government might give a free grant of land to a man with some capital on conditions.

I think this correspondence should be printed for private circulation. Mr. Mathieu seems to have no objection. Could you undertake to arrange the papers for the Government Printer, and to revise proofs?

Yours sincerely,
(*Signed*) W. H. TREACHER.

FURTHER NOTES ON RAMIE CULTIVATION.

It is by no means to be taken for granted that any land in the Straits will grow ramie, as has been assumed by several people who have written on the subject. The following instances will make this clear. Some plants were obtained by Mr. H. A. W. Aylesbury from the Botanical Gardens, Penang, on the 9th May, 1897, and planted at Kampong Dew, in freshly cleared jungle land, and Mr. Boyd, the Manager, reports that they are now, after the lapse of nine months, only about one foot high, and growing very badly. In the same soil coffee, Para rubber, coconuts, nutmegs, padi, etc., are growing most satisfactorily. Mr. F. A. Stephens, at Jebong Estate, also reports that ramie does not grow with him. The Messrs. Tait have planted a few clumps in rich alluvial land at Tanjong Malim, and they look miserable, while in the same beds are balsams and other flowers, which are growing luxuriantly.

An analysis of the ashes of the plant shews that the main constituents of the soil which are required by the plant are potash, soda, lime, common salt and phosphoric acid. It is a deficiency of one or more of these substances which renders the soil in places unsuited to the growth of ramie, and in attempting to grow it in such localities a careful soil analysis would have to be made, and the manuring so managed that this constituent is supplied in a form that may be accessible to the plant. We know that in most districts of Perak there is a great deficiency of lime and phosphoric acid.

There is some ramie growing well near Taiping, on the red soil formed by the decomposition of granite, almost *in situ*. In such soil the decaying feldspars of the granite would probably yield nearly all the mineral substances required by the plant, in a form that it could assimilate.

The unsuitability of the soil can be remedied by the intelligent application of manure, but climate is beyond control, and the rainfall is therefore the most important of all points to take into consideration in choosing the locality for the cultivation of ramie. It must be not only large, but it must be evenly distributed throughout the year, otherwise the crop will be damaged by each drought. The effect of dry weather is that the stalks, instead of growing up straight and single, become stunted, crooked and much branched, in which state they are useless for producing anything but the most inferior quality of fibre. Further, it is necessary, on the setting in of the rains after a drought, to cut out all these dry weather stalks as, though they may eventually grow tall, they will never produce good straight fibre. The loss is therefore not confined to the period of the actual dry weather.

An examination of the rainfall records of this State, shews that the area which is best suited to the growth of ramie is that which stretches between Taiping and Selama, at the base of the Bubo-Ijau-Inas range of hills. As the distance from the hills increases the rainfall diminishes, and at distances of about six miles from the base of the hills near Taiping not one half is recorded. There is a considerable quantity of unoccupied land in this tract of country, which is all most excellently situated in respect to transport, as it is well served by roads and the railway line now in progress.

The rainfall for the past eighteen years recorded at Taiping and Selama is given in detail in the subjoined table. In the last column is given the mean rainfall deduced from the monthly records. The same facts are shewn graphically in the accompanying diagrams. The observing station at Taiping is in the hospital, and is situated some two miles from the foot of the hills. At Selama, which is about thirty miles distance in a northerly direction, the observatory is also in the hospital and is six or eight miles from the base of the hills, but there the foot-hills extend to a much further extent than they do near Taiping, projecting from the range in ridges between the valleys, and apparently carrying the area of excessive rainfall much further out from the range. A careful inspection of these statistics will shew that for ramie cultivation the climate of this portion of the State is almost ideal.

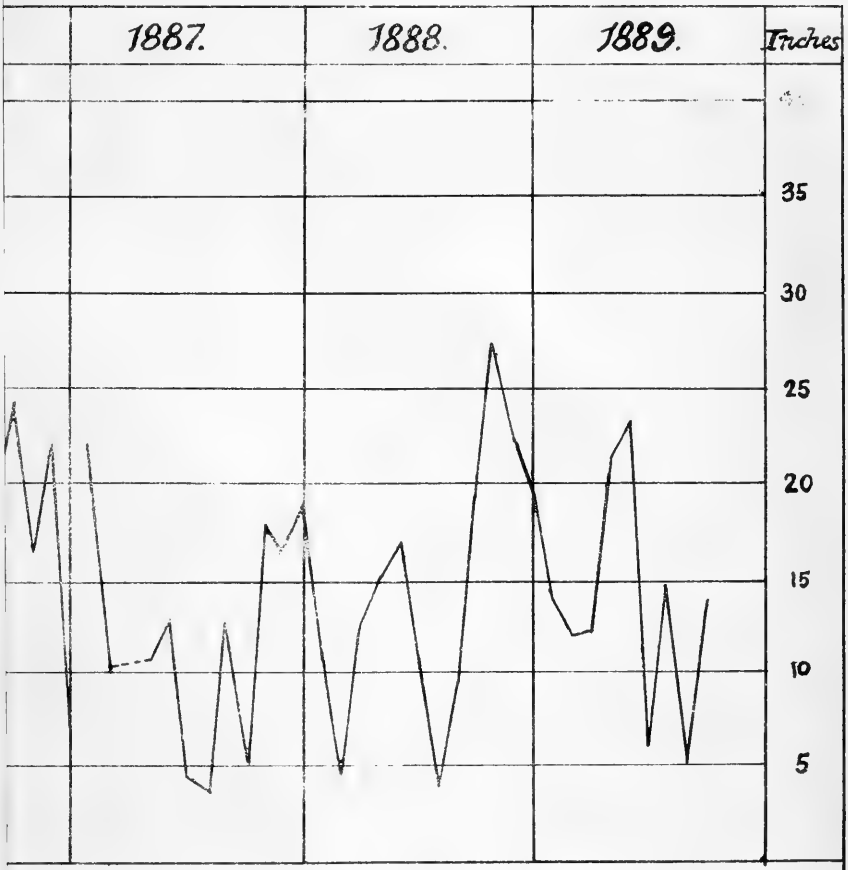
TAIPING RAINFALL FROM 1880 TO 1897.

	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	Mean Monthly.
January ...	9·72	11·74	20·63	8·76	13·60	4·54	8·32	21·91	10·30	13·51	15·86	14·30	8·70	8·61	12·14	11·76	14·59	14·06	12·94
February ...	7·64	8·84	15·62	5·12	21·80	16·35	7·76	9·87	4·51	11·95	12·02	7·61	17·72	8·03	11·37	13·76	18·30	19·09	12·06
March ...	16·20	4·23	10·12	37·19	10·60	14·54	9·26	...	12·11	12·06	11·29	4·40	16·76	15·43	12·74	14·86	21·64	28·84	14·83
April ...	18·33	14·18	16·20	37·06	25·16	21·42	18·90	10·73	15·15	21·36	18·84	13·07	17·65	17·52	14·36	18·59	19·08	17·31	18·60
May ...	29·67	9·04	9·06	18·29	14·14	20·37	12·64	12·60	17·08	23·32	14·15	12·73	22·81	14·61	5·21	14·28	5·98	12·47	14·91
June ...	4·79	18·48	2·44	5·48	12·68	15·27	4·79	4·45	10·67	6·13	5·13	4·23	9·70	3·72	7·47	13·06	5·20	8·94	7·92
July ...	5·04	13·59	6·44	4·86	2·15	4·06	18·22	3·88	3·83	14·85	12·21	2·42	1·60	11·46	4·79	16·51	4·02	4·04	7·44
August ...	8·95	16·45	11·46	20·59	12·49	11·39	18·06	12·77	9·69	5·18	13·38	11·49	10·70	14·34	5·55	5·41	3·41	11·14	11·24
September	7·57	19·88	8·66	6·00	4·23	21·19	24·18	5·26	19·55	13·85	1·34	18·17	7·71	11·65	3·64	8·22	20·37	9·76	11·73
October ...	18·55	22·27	33·81	21·24	16·07	25·45	16·29	17·73	27·50	13·24	17·22	25·86	19·53	23·10	17·98	41·54	17·62	18·66	21·88
November ...	24·28	13·89	21·40	36·99	19·98	19·23	21·77	16·52	22·09	11·16	11·04	20·98	10·23	13·29	14·54	11·32	27·35	14·49	18·36
December ...	7·72	25·20	20·94	19·81	10·71	16·13	7·26	18·91	19·41	9·08	13·49	21·61	9·03	10·08	10·87	14·73	18·01	20·34	15·18
	158·46	177·79	176·78	221·39	163·61	189·94	167·45	134·63	171·89	155·69	145·97	156·87	152·14	152·14	120·66	184·04	175·43	179·14	167·15

SELAMA RAINFALL FROM 1880 TO 1897.

	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	Mean Monthly.
January ...	...	14·94	13·30	·85	10·65	3·33	5·35	12·86	2·46	14·08	11·62	7·62	4·16	2·26	4·34	9·15	10·06	5·16	7·77
February ...	...	4·18	7·62	2·76	10·61	6·61	6·21	8·77	5·83	3·04	14·12	10·15	8·84	4·00	5·00	6·61	10·20	13·46	7·53
March ...	...	6·00	6·41	14·89	5·23	3·57	7·99	17·65	14·91	10·22	9·81	11·10	10·93	19·74	5·70	10·62	10·22	16·48	10·66
April ...	...	10·53	23·45	15·76	14·87	14·07	10·48	15·71	11·08	17·00	10·35	13·32	18·59	14·92	18·45	16·62	16·71	19·90	15·93
May ...	...	14·97	11·49	13·95	7·47	26·98	20·09	11·07	12·66	19·65	8·59	6·56	11·47	21·91	11·29	4·31	9·19	9·50	13·00
June ...	...	3·95	·51	3·08	9·59	13·68	5·76	7·88	6·53	4·45	8·40	6·10	15·39	10·81	6·49	12·00	10·88	9·91	8·05
July ...	...	5·97	10·18	1·48	5·58	10·28	15·74	6·35		9·16	13·98	3·28	2·30	11·60	5·44	11·85	5·87	5·24	7·76
August ...	...	8·60	2·04	8·43	3·98	11·83	13·07	15·13	7·20	9·85	9·35	7·98	9·71	12·49	3·67	8·78	3·86	8·69	8·50
September ...	...	12·26	2·18	10·73	8·55	21·15	18·06	2·87	12·09	13·23	10·39	12·39	6·98	10·74	3·68	11·29	15·67	8·63	10·64
October ..	5·05	21·46	20·96	12·07	18·42	21·80	13·45	17·44	22·03	11·72	15·07	24·39	13·07	13·87	16·34	26·49	15·51	15·70	16·93
November...	11·78	12·15	17·03	23·42	15·96	14·43	12·27	17·76	20·65	16·36	14·24	30·81	12·50	11·16	9·14	7·57	25·75	9·81	15·71
December ...	11·76	17·46	14·13	7·21	4·75	18·08	6·33	10·75	19·72	6·81	8·89	12·93	11·12	4·39	8·02	11·64	12·67	14·55	11·17
	28·59	132·47	129·30	114·63	115·66	165·81	134·80	144·24	135·16	135·57	143·81	146·63	125·06	137·89	97·56	136·93	146·59	137·03	133·71

ng from 1880 to 1897.



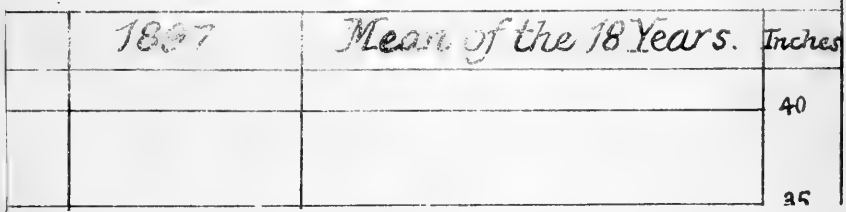
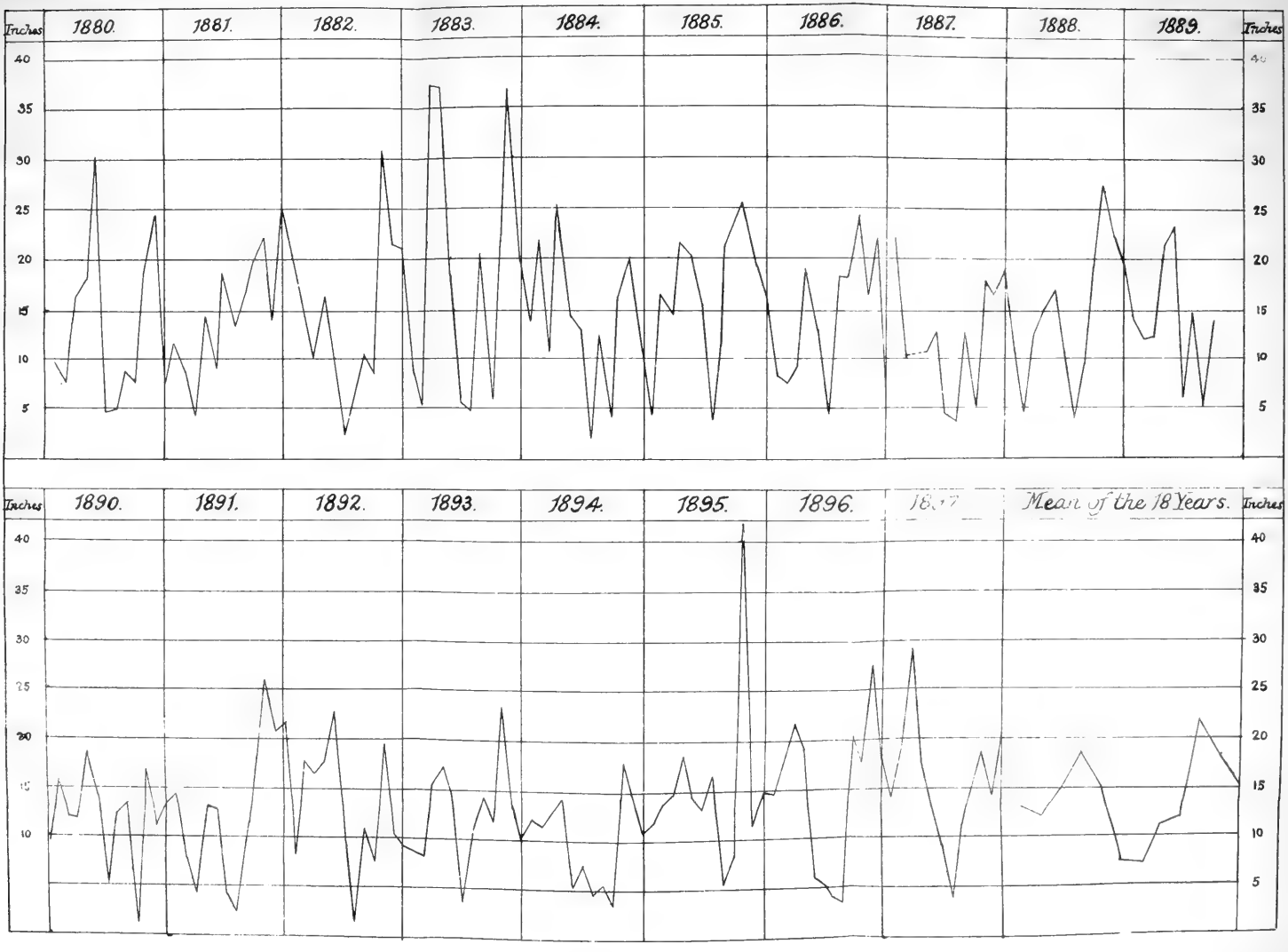
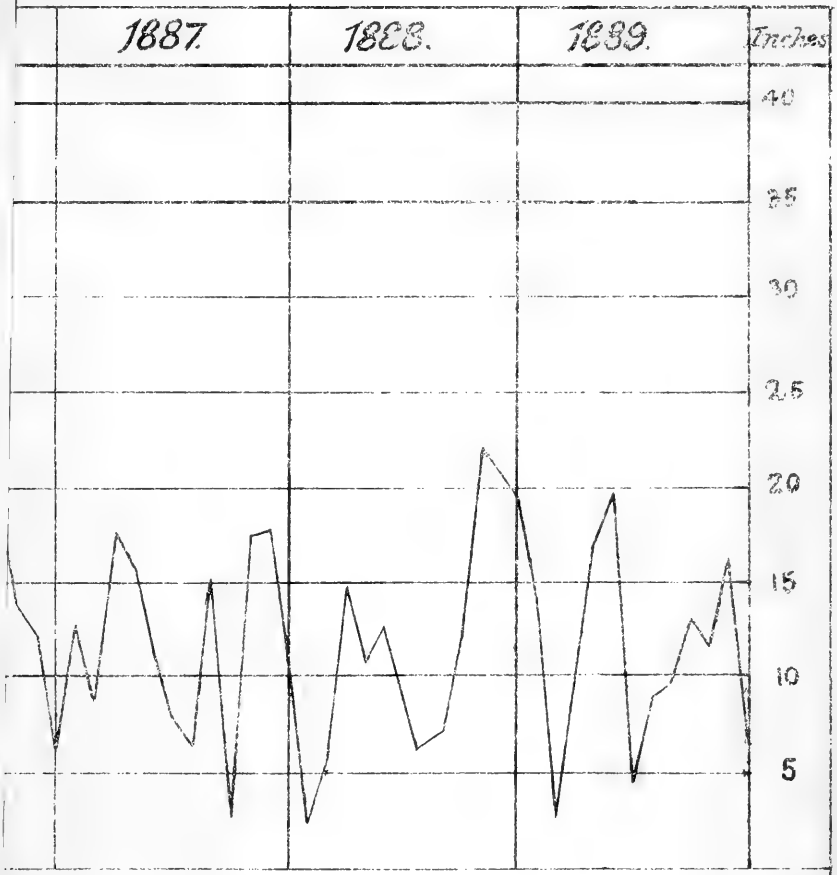


Diagram Shewing the Monthly Rainfall registered in Taiping from 1880 to 1897.



ma from 1880 to 1897.



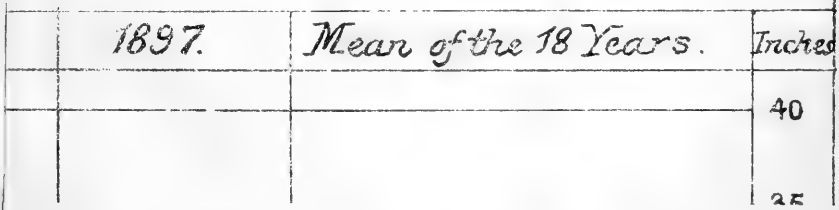
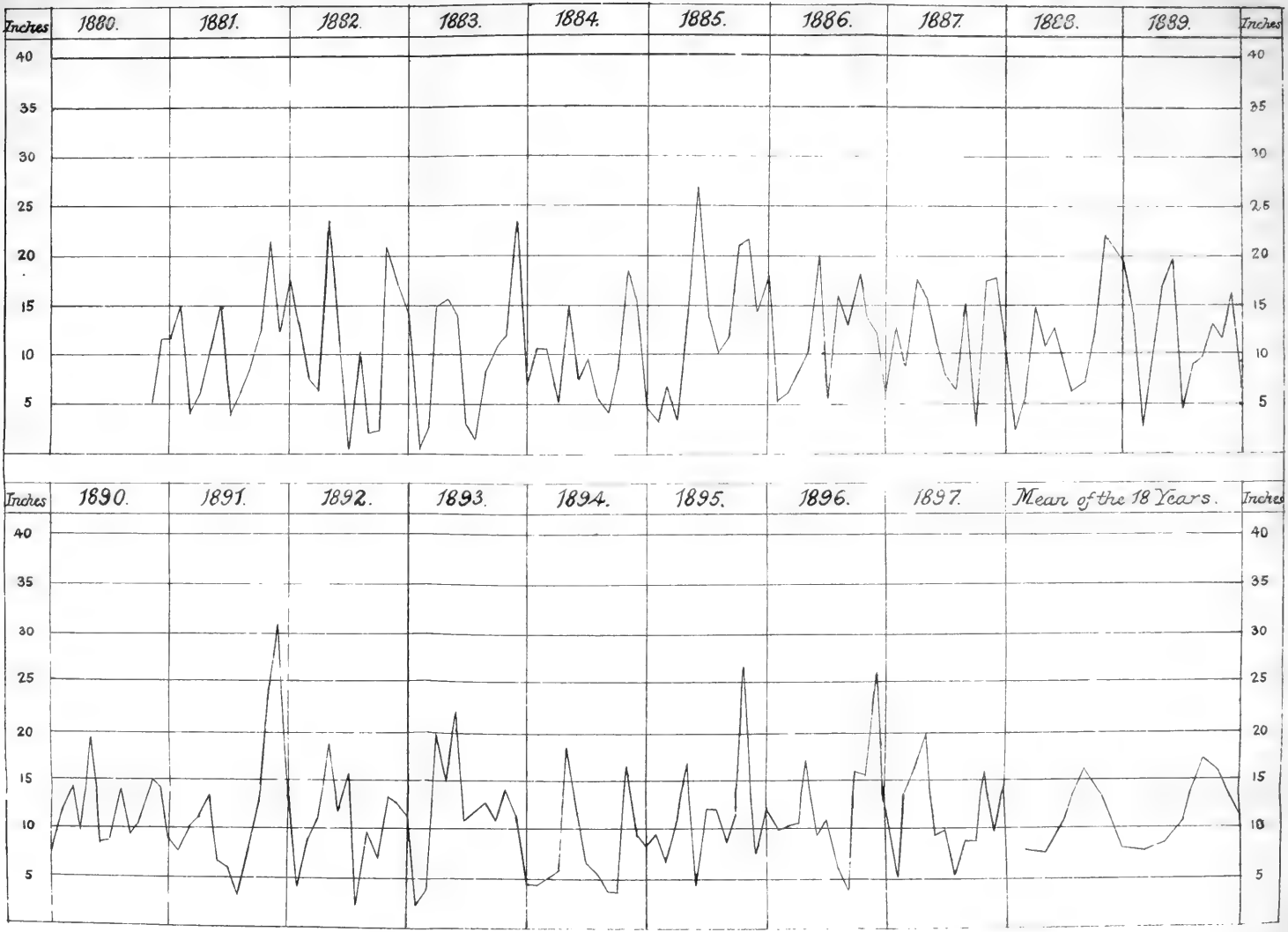


Diagram Showing the Monthly Rainfall registered in Selama from 1880 to 1897.



There are a number of patentees in the field, who want to make arrangements with planters to use their machines or processes, and it is quite necessary to point out that they should not be treated with unless, after a careful search in the Patent Office, it can be proved that their patents are valid. It is to be remembered that the possession of a patent in no way implies that the invention is new, or that the document is worth more than its value as waste paper. The English Patent Office will grant any number of patents for the same invention, though only the one which was taken out first is valid. The Office takes no responsibility in the matter, that rests wholly with the patentee. It is also to be remembered that an English, or even a Straits patent, gives no right to the holder to charge royalties or in any way interfere with the use of the invention in the Native States, nothing but a local grant will do that, and up to the present time no rights have been granted in the Native States for the treatment of ramie, so that any machine or process may now be used in the Native States free of all royalties.

The large reward offered for many years by the Indian Government, and other rewards offered in France, have turned the attention of numbers of people to the subject, and many patents, amounting to some hundreds, have been taken out for the treatment of ramie, so that at the present day it would be an excessively difficult thing to invent a decorticator or de-gumming process which would form the subject of a patent maintainable in a Court of Law. Every imaginable form of drum, beater and scutcher, and combination of them, has been patented over and over again. Many machines have been built and tried, but the greater proportion have never gone beyond drawings and descriptions. Most probably amongst these latter are some machines which would work if decorticating is practicable on a commercial scale.

A document has lately been circulated locally, by the owner of a decorticating machine, offering to sell his machines subject to a royalty. According to the figures given in this paper a set of decorticators and the engines to drive them would cost £1,898 and the charge for the use of them would be the modest sum of £10,787 per year.

The "Gomess" process owners, I understand, are willing to put up works, if a sufficiently large area of cultivation is guaranteed, and treat the ramie, on condition of receiving 25 per cent of the out-turn. This is a more reasonable proposition, though it is doubtful if it could be worked in practice.

In the foregoing correspondence Mr. Mathieu urges the impossibility of producing ribbons by boiling the stems and hand scutching, but as it has been done there is no reason why it could not be done again. This process is known as the "Fleury-Moriceau" process, and was worked at the Paris Exhibition of 1889 and, according to the official report made for the Government of India, and published in the *Kew Bulletin*, one small tank was proved by actual trial to be capable of turning out one hundred and sixty-six pounds of dry fibre per day of ten hours. The time of boiling was from five to fifteen minutes, according to the age of the stems. These are facts which shew that the boiling process can hold its own with most if not any of the decorticators at present invented. It is also to be remembered that there is no loss of fibre by this process, that the whole of the wood is removed, that the ribbons are not broken or twisted in any way, and that they are in excellent condition for passing straight into the de-gumming tanks. Any person with a certain amount of mechanical ability would have no difficulty in improving the process so that a tank would turn out twice the amount stated and at the same time reduce the handling to a minimum. This would be done by using the waste heat to raise the temperature of the stems to near the boiling point before actually going into the bath, and by having a continous mechanical traveller to put them through the apparatus in place of doing it by hand in batches. There would appear to be no difficulty in designing a boiler of this description capable of treating the annual produce of one acre of land in the space of three days. If carefully designed so as to prevent the loss of heat, the stalks would supply all the fuel necessary, and two men should be able to work it and scutch the stems.

The machine which took the gold medal at the last trials in Paris was the "Faure" machine, which has already been mentioned. It is sold at £36 in London, and appears to turn out fibre nearly equal in value to hand prepared China-grass. The London agent, Mr. T. Barraclough, also advertises to supply apparatus for de-gumming quite free from all patent rights.

ANNUAL REPORT ON THE PERAK MUSEUM FOR 1896.

By L. Wray, Jun.

CASES.

During the year two 24-feet by $4\frac{1}{2}$-feet table cases were built to replace four old cases containing the collection of Malayan weapons. Two 15-feet by $4\frac{1}{2}$-feet table cases were glazed with plate in place of common glass, and a large pier case was also glazed with plate glass. Five new insect cabinets, on a novel plan of construction, were partly built. These latter are to take the insects which cannot be put out into the exhibition cases.

A sum of $460.22 was expended on case building, while all the glazing, varnishing, painting, etc., was done by the Museum staff.

LABELS.

Type written labels have now nearly entirely replaced the old hand written ones, and about a thousand cards for the Library Card Catalogue were also type written.

ETHNOGRAPHY.

Further extensive additions have been made to the collection of Malay silver work, 96 pieces having been purchased. This brings the number up to over 400 pieces in all.

Mr. E. W. Birch presented a very fine example of an early Malayan tombstone, obtained from the Bruas district. This is the second now in the collection. A number of beautifully executed models of Siamese boats were purchased, and a considerable number of Malayan household appliances, traps, fishing gear, games, etc., were collected, while a few weapons were added to the already large series of these objects previously obtained.

The great requirement in this section is more space. Three times the present floor space could easily be filled without going outside the Malayan region. Another class of exhibit for which

there is now no room is a collection of ethnographical photographs. This would be a most interesting addition to the section.

HERBARIUM.

Five hundred and two mounted and named herbarium specimens were received from the Royal Botanic Gardens, Calcutta, and added to the herbarium.

ECONOMIC BOTANY.

This section has been much increased, and could be further extended with advantage if space would permit. A well-made copper oven was obtained from England to take the place of the make-shift locally made one previously in use, and has been found to be of great service in drying and devitalizing specimens previous to sealing them up in the glass topped tins, which have been so successfully used for preserving them for some years past.

An interesting series of samples from the Trans Krian sugar estate was presented by Mr. F. Pulsford. Specimens of cleaned Perak grown ramie fibre, and many other vegetable products were added to the collection. Amongst these mention may be made of some particularly well cured Liberian coffee from an estate near Gopeng, contributed by Mr. F. D. Osborne. This coffee has been fetching a better price in Singapore than any other produced in the Straits. The high value placed on it is due to its colour, and not to any superiority of the bean. The Liberian coffee grown on the hill at Waterloo Estate apparently has a finer bean than any from the plains. Some trees planted by Mr. Cecil Wray, in 1880-1, are well grown, vigorous bushes in full bearing, while trees of four years old planted by Sir Graeme Elphinstone, on land cleared twelve years previously, compare most favourably with bushes of the same age on the low lands planted on newly cleared forest land.

The collection of Perak woods now numbers 207 examples. It is of more than ordinary interest as it shews that there are so many fine and handsome woods in the jungles besides the four or five kinds known to Europeans.

GEOLOGY.

The general collection of rocks and fossils has been arranged and put out in a table case, and the local geological and mineralogical collections much extended, owing to the appropriation of another table case to their accommodation. A series of very interesting gold specimens was presented by Mr. W. Bibby,

from the Raub mines, and another by Mr. T. Blamey from the Punjon mine, while Mr. Treloar gave a collection illustrating the processes of dressing lode tin-ore.

STAFF.

The Taxidermist retired on pension at the end of 1895, and the Crown Agents have been unable to engage any one to fill up the vacancy on the terms offered by the Government, so that there has been no Taxidermist during the whole of 1896.

Mr. Reutens, the caretaker, was promoted to a clerkship in the Secretariat on the 6th July, and his place was filled up by Mr. J. A. Jansen from the Audit Office. On the 30th November his services were dispensed with and Mr. Low Leng Fong, the Assistant Taxidermist, who had been refused any increase in his then position, was appointed as caretaker. A new man, Mr. Low Kooi Fong, was taken on as Assistant Taxidermist at the end of December. It is perhaps unnecessary to say that these changes and the vacancy already mentioned have seriously interfered with the work of the Department.

FINANCIAL.

The unexpended balances for the year amounted to $131.40, or, including Establishments, to $1,356.40. The revenue collected during the year was $155.18, against an estimate of $50.

9th March, 1897.

LIST OF THE PRINCIPAL ADDITIONS TO THE MUSEUM COLLECTIONS, BY PURCHASE, COLLECTION AND DONATION, DURING THE YEAR ENDING DECEMBER, 1896.

Kait Parangai.

A Curved Knife.

Malay Scales.

A Snake. (*Given by H. C. Barnard, Esq.*)

A Silver Pending.

Model Sugar Cane Press.

Malay Stocks.

Two Rat Traps.

One Brass Dish and Lamp.

Flowering Specimens of the Tree which yields Malay Varnish.

Sappan Wood.

Water Bottles.

Fishing Spears.

Silver Batil Bertutup.

Silver Sirih Leaf Holder.

Silver Lime Box.

Silver Pinang Box.

Silver and Suasa Tobacco Box.

A Spider, Upper Perak. (*Given by Inspector F. S. B. Lamb.*)

A Burmese Silver Coin found in Taiping. (*Given by Mr. S. A. M. Reutens.*)

A Silver Chaping.

Three Breeding Pearls.

A Silver Water Jar.

Four Silver Panels, 4 Silver Gilt Ornaments, and 2 Silver Balls.

Silver-mounted Coconut-shell Water Bottle.

Cotton Mill and Spinning Wheel.

Malay Anchor.

Wheel for making Pottery.

Rice Mill.

Water Jar.

A large Silver Batil.

A Silver Batil Bertutup.

A Silver Plate.

Three hundred and four mounted Herbarium Specimens. (*Given by the Superintendent Royal Botanic Gardens, Calcutta.*)

A Bat.

Two Throwing Spears, Patani pattern.

Models of Malay Mining Implements.

Two Model Pig Traps.

Two Brass Sirih Holders.

Obsidian, from Pahang. (*Given by D. H. Wise, Esq.*)

Malay Silver Ladle in form of a Sendok.

A Gee Hin Banner. (*Given by C. Wagner, Esq.*)

Alluvial Tin from Siak, Kinta. (*Given by F. C. Langford, Esq.*)

A Caterpillar. (*Given by P. J. Nelson, Esq.*)

Sample of Gutta Percha from Dichopsis Clarkeana.

Two Silver Kris Holders.

Insects said to injure Padi. (*Given by A. W. Just, Esq.*)

Large Brass Dish on Foot.

Quail and Fish Traps.

Starch from Ubi Ara.

Aker Kunyit.

An old Larut Police Badge, found at Matang. (*Given by Mr. Ho Pak Leng.*)

Portrait of H.H. the Sultan of Perak. (*Given by H.H. the Sultan of Perak.*)

A Dulang used for separating Gold from Tin-sand.

A Basin used in separating Gold from Tin-sand.

A Silver Cooking Pot.

A Silver Batil.

A Silver Tobacco Box.

A Silver Hair Comb.

A Silver Gilt Kilat Dai.

Silver Lime Box.

Silver Chimbal.

A Karangtong.

Kabong Vinegar.

Fish Traps.

Water Bottle Covers.

Sticks used by Malay women for blacking the teeth.

Judicial and Revenue Stamps. (*Given by the Acting State Treasurer.*)

Model of Spring Gun.

Model of Spring Trap.

Model of Bow Trap for small Animals.

Specimens of Stinging Trees, called Jelatong Gajah and Rusa.

Malay Dish Cover.

A Gun formerly the property of the first Resident of Perak, and taken from his boat when he was murdered at Pasir Salak. (*Given by E. W. Birch, Esq.*)

A Silver Tobacco Box.

A Butterfly from the Kinta hills. (*Given by E. L. Bailey, Esq.*)

Pahang Tin Money. (*Given by D. H. Wise, Esq.*)

A Teal, (Dendrocygna Javanica.)

A Heron.

The Indian Ringed Plover, (Aegialitis Philippensis.)

A Boat-shaped ingot of Tin found in Tupai. (*Given by J. Ward, Esq.*)

A Silver-mounted Buntal Kris.

A large Silver Tobacco Box.

A Silver covered Cup for Oil, (Mangko Bertutup.)

A Silver Tablet used for Divination, called Chuchu Karah.

Edible variety of Castor Oil Seed.

Two young Bamboo Rats.

A Biauak.

A Boat-shaped Dulang, Batang Padang.

A Malay Tin Crocodile.

A series of eight Samples of Lode Tin-ore at different stages of dressing. (*Given by T. H. Treloar, Esq.*)

Residue left after washing Tin-ore for Gold. (*Given by C. C. Scott, Esq.*)

A sample of the first Gold obtained by the Cyanide Process in Perak. (*Given by Sutton, Esq., Manager, Bukit Mas Mine.*)

A sample of Alluvial Gold from Bukit Mas, near Tapah.

A Tapir.

A Screw Press used for making a kind of Macaroni.

A Spear with two blades.

A small Water-rail, (Porzana Cinerea), Kamunting.

Twenty-three species of Marine Shells, from Singapore.

Two Sea Horses.

A covered Silver Cup, on foot.

A Coconut Shell Spoon.

A pair of Carved Coconut Shell Censers.

Silver Scent Bottle.

Silver Pillow Ends.

A Poko Nasi and Poko Sirih.

Two Malayan Dish Covers.

A Silver-mounted Fern Stem Basket.

Two Mat Baskets.

A carved Wooden and Coconut Shell Spoon.

Two Water Bottle Covers.

A worked Dish Cover.

Implements for Piercing the Noses of Buffaloes.

A Malay Silver Dish on three feet, with Cover.

Two Silver Spear Mounts.

A Silver Pending.

A Silver Chaping and Clasp.

Three Silver Buah Bharu.

A Silver Lime Box.

A Silver Chimbal.

A Silver Lime Box.

A Silver Chaping.

Two Wooden Trays for Cleaning Sekua, Semang.

Two spud-shaped Spears.

A Brass Sangku.

A Silver Labu Ayer.

A pair of Silver Pillow Ends.

Three pairs of Silver Pillow Ends.

Two Taji Biji Durian, a Malay Game.

Silver Dish, on foot.

Silver Water Bottle, (Labu Ayer.)

Stamp of Sir Hugh Low, formerly used to stamp official correspondence, etc. (*Given by W. H. Treacher, Esq.*)

A small Iron Gun found in making the foundation for the new ward in the Gaol at Taiping. (*Given by G. M. Gregory, Esq.*)

A Silver Ankob.

A Silver Gunong Sumpit Bras.

A Nycticebus Tardigradus.

A pair Silver Pillow Ends and an Angkob.

A large Silver Chimbal.

A pair of Silver Anklets.

A Silver Bunga Kitor.

Four Tiles made by the Union Brick Yards, Krian. (*Given by G. Bird, Esq.*)

Silver Chimbal.

Two Silver Lime Boxes.

One Silver Bead.

A Silver Angkob.

A set of four Silver Chimbals.

A collection of eleven Specimens of Gold Quartz from the Raub Mine, Pahang. (*Given by W. Bibby, Esq.*)

Two Samples of Liberian Coffee from Gopeng. (*Given by F. D. Osborne, Esq.*)

A collection of seventeen Malayan Tin Animals, Kinta.

Specimen of Loadstone, Tambun, Kinta. (*Given by Cecil Wray, Esq.*)

Galena from Tanjong Rambutan, Kinta. (*Given by Cecil Wray, Esq.*)

A Silver Water Jar.

A collection of Minerals. (*Given by C. C. Scott, Esq.*)

Two samples Sugar. (*Given by F. Pulsford, Esq.*)

Three samples Rum. *Do.*

One sample Molasses. *Do.*

One sample Arrowroot Flour. *Do.*

Two samples Rum Shrub. *Do.*

White Mica and Quartz. *Do.*

Eight Photographs of natives of the Island of Nias. (*Given by G. B. Cerruti, Esq.*)

A collection of Basket Work.

A Silver Batil Bertutup, on three feet.

A Brass Plate.

A Silver Lime Box.

Head of a Buffalo.

A large Silver Sirih Box containing four Chimbals.

Three Bird Skins.

Two carved Coconut-shell Spoons.

Nutmegs and Mace, Kamunting.

Three Silver Siamese Coins. (*Given by Mr. Choomsai.*)

A Silver Box and Plate, called Telop.

A Silver Water Jar Cover.

A sample of Iron Pyrites in Quartz, Selama. (*Given by N. Kendall, Esq.*)

Samples of native prepared Ramie Fibre.

Sample of Ramie Fibre prepared by the "Gomess" Process. (*Prepared in the Museum.*)

Samples of Dried Chilis (4 varieties), Ground-nuts, Betel-nuts, Aker Kunyet, Cloves, Kunyet, etc.

An Owl. (*Given by Mr. E. Lesslar.*)

Pair Silver Bracelets.

An ancient Malay Tombstone, from Ulu Bruas. (*Given by E. W. Birch, Esq.*)

Alluvial Wolfram, Chumor. (*Given by G. B. Cerruti, Esq.*)

Auriferous Dyke-stone from 64 feet level, Bukit Mas Mine. (*Given by J. Addis, Esq.*)

Two samples of Ramie Fibre, grown in Perak and dressed by the Société de la Ramie Française. (*Given by F. D. Osborne, Esq.*)

Dried Getah Taban Leaves. (*Collected.*)

Dried Getah Taban Bark. (*Collected.*)

Malay Coconut-shell Scratch-back.

Tin Mounted Coconut-shell Teapot.

Main Kumbang, a Malay Game.

Tandok Krebau, a Malay Game.

Seven models of Siamese Boats.

Two Siamese Musical Instruments.

A Squirrel Trap.

A Collection of 60 Shells.

A Trap to catch Broh.

A Fishing Net, Pukat.

Specimens of Euthalia Adonia and Charaxes Schreiberi. (*Given by Mr. B. Jalleh.*)

Collection of Gold Quartz and other specimens from the Penjom Mine, Pahang. (*Given by T. Blamey, Esq.*)

A Tortoise (Geoemyda Spinosa), Penang. (*Given by S. S. Flower, Esq.*)

A Toad, Penang, (Bufo Quadriporcatus). (*Given by S. S. Flower, Esq.*)

A sample of native Amalgam, from a mine at Changkat Mamot. (*Given by G. B. Cerruti, Esq.*)

A Silver Writing Case and Bead.

A Gold-mounted Silver Pending.

A Silver-mounted Hair Comb.

A Gold-mounted Silver Lime Box.

A Silver Box and Plate for hair oil.

A Kwang Tung Coin.

A Tiger Civet, (Prionodon Sp.)

A Tortoise.

A Leaf Insect. (*Given by E. W. Birch, Esq.*)

An Instrument of Discipline formerly used in Malay Schools. (*Given by W. T. Wrench, Esq.*)

Sample of Lode Tin-ore from Jeram Batang, Kuantan, Pahang. (*Given by W. T. Wrench, Esq.*)

A Locust from "The Cottage." (*Given by F. A. Swettenham, Esq.*)

A Snake from "The Cottage." (*Given by F. A. Swettenham, Esq.*)

A Mungoose, (Herpestes Mongo.) (*Given by S. S. Flower, Esq.*)

Five samples of Barks used in Tanning.

A Silver Dish with Cover.

Five Silver Spoons, 1 Bead, 1 Chaping.

A Prionodon.

A Silver Tüe for reaping padi.

Two Snakes from "The Cottage." (*Given by F. A. Swettenham, Esq.*)

Samples of Palm Sugars.

Fifteen varieties of Coconuts.

LIBRARY.

Annual Reports of the State Mineralogist, California State Mining Bureau, for the years 1886 to 1894. (*Given by the State Mining Bureau of California.*)

Bulletin of the California State Mining Bureau, Nos. 1 to 6. (*Given by the State Mining Bureau of California.*)

Thirteen Geological Maps and Plans. (*Given by the State Mining Bureau of Califoria.*)

Annual Report of the Department of Agriculture, Queensland. (*Given by the Department of Agriculture, Queensland.*)

The Hikayat Raja Budiman, A Malay Folk Tale.

The Hikayat Raja Budiman, English translation.

Annals of the Royal Botanic Gardens, Calcutta. (*Given by the Superintendent, Royal Botanic Gardens, Calcutta.*)

If Public Libraries why not Public Museums, by Edward S. Morse. (*Given by the Smithsonian Institution.*)

Records of the Geological Survey of India. (*Given by the Director of the Geological Survey of India.*)

Smithsonian Report, United States National Museum, 1893. (*Given by the Smithsonian Institution.*)

The Flora of British India, Part XXI. (*Given by the Director of the Royal Gardens, Kew.*)

Agricultural Bulletin of the Malay Peninsula, No. 5, 1896. (*Given by the Botanic and Forest Department, Singapore.*)

East Coast Etchings, by H. Clifford.

Anales Del Museo Nacional, Montevideo, No. 4, 1896. (*Given by the National Museum of Montevideo.*)

Horn Measurements and Weights of the Great Game of the World, by Rowland Ward. (*Given by the Publisher.*)

Heliozoa Bearbeitet, Von Dr. F. Schandiun. (*Given by Herren R. Frieldlander and Sohn, Berlin.*)

Indian Museum Notes, Vol. III, No. 6, and Vol. IV, No. 1. (*Given by the Trustees of the Indian Museum.*)

The Principles of Museum Administration, by G. Brown Good. (*Given by the Author.*)

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