1921 | KENYA | C.O. 28747 | Reg^d 9 JUN 21

KEW GARDENS

Date 9TH JUNE 1921

209

SUBJECT

"PROBLEMS OF ECONOMIC BIOLOGY IN EAST AFRICA"

BY W.J.DAWSON

Paper is of considerable interest. Suggests printing. Will arrange for printing in Kew Bulletin which will ensure wide publication, and supply spare copies for Kenya if wished. Returns paper but if above is agreed to asks for copy.

Circulation: Mr. ... Mr. Fiddes. ... Secretary.

Previous Paper

12/8/19

MINUTES

~~Mr [illegible]~~

? acknowledge receipt thanks for suggestion & say that Mr Dawson, who is being consulted, has no objection but will be glad to avail himself of Kew's offer.

? consult Mr Dawson

ACCB

10/6/21

An excellent idea from our point of view

[illegible] 11.6.21

[illegible handwritten marginal note]

Subsequent Paper

31383

[illegible signature]

Royal Botanic Gardens, Kew.

28747

June 9th 1921.

REC'D REG 9 JUN 21

Sir,

I have to acknowledge receipt of Colonial Office letter No. 372/1921 of June 7th, 1921, enclosing copy of a letter from Mr. W. J. Dowson with his paper in original entitled "Some account of the Problems of Economic Biology in East Africa".

The paper is a communication of considerable interest not only for biologists and planters in East Africa but also in other parts of the Empire and I beg to suggest that it should be printed in extenso.

I shall be pleased, if you concur, to publish the paper in the Kew Bulletin which will ensure its wide circulation and I could arrange, should you so desire, to furnish you with some separate copies for distribution in Kenya.

The paper is returned as requested and if you agree that it should be published in the Kew Bulletin I shall be glad to be supplied with copies of the map and diagram referred to by Mr. Dowson in the course of the paper for reproduction in the Bulletin.

I am,

Sir,

Your obedient servant,

D. Prain

Director.

The Under Secretary of State,
Colonial Office,
Downing Street.

SOME ACCOUNT OF THE PROGRESS OF ECONOMIC BIOLOGY IN EAST AFRICA (KENYA COLONY)

BY

E. J. CORBOR, M.A., F.L.S.

SOME ACCOUNT OF SOME PROBLEMS OF ECONOMIC BIOLOGY IN EAST AFRICA (KENYA COLONY)

by

W. J. DOBSON.

INTRODUCTION.

The following paper is the outcome of some years' observation of the diseases of plants in East Africa. The word "observation" is expressly used because the country is so large and the facilities for mycological work are so inadequate that a large part of one's time must be occupied in the field. In what follows, some diseases are described from this point of view only, and require a considerable amount of laboratory and inoculation work before a complete knowledge of their mode of attack and life history can be attained. In addition to field work, the problem of wheat breeding further interfered with any investigation requiring considerable laboratory work. Hence it was rare for any such investigation to reach conclusion and in the majority of cases the work had to be dropped for some more pressing problem

The effect of meteorological conditions on the relations between the host and its parasite is a subject which as yet has received but little attention at the hands of the pathologist but which in a country like East Africa supplies the key to the solution of the problem concerning the severity of attack.

For the full understanding of the problems which confront the economic botanist and the agriculturist mycological it is essential, in the first place, to gain some knowledge of the physiographical and climatic conditions of this part of Africa, conditions so varied in extremes as to affect both host and

parasite is a marked degree. East Africa, also known as British East Africa and the East Africa Protectorate, but now called Kenya Colony from the name of the great mountain mass in its centre, is situated between the 4th parallel N. latitude and the 4th parallel S. latitude. The area of the country is nearly twice that of the United Kingdom, but its population, all [illegible] amount to more than 5 millions. The equator passes through the northern slopes of Mount Kenya, the serrated and glacier-covered peak of which rises a few miles south to a height of 17,000 odd feet. 180 miles due south of Kenya and just within Tanganyika Territory is Mount Kilimanjaro, whose summit in the shape of an inverted bowl rises 19,000 odd feet above sea level, and 180 miles due W.N.W. direction from Kenya, and on the boundary line separating Uganda from East Africa lies Mount Elgon, a huge symmetrical crater 14,000 feet in height. These three mountain masses and many others, smaller in size, are extinct volcanoes formed in late tertiary times. The snow line is situated at an altitude of 15,000 feet above sea level.

It must be borne in mind that these numbers are apt to give an exaggerated impression of altitude. The height of the [illegible] mountains from the general level of the surrounding country is considerably less by reason of the fact that these mountain masses rise from plateaux and uplands of 5000 to 7000 feet. Thus the highest point of Kenya from the general level of the surrounding country is, roughly, 11000 feet.

Running north and south right through the country is the Great Rift Valley, one branch of which stretches from Lake Rudolph in the north to Kilimanjaro in the south, where its general contours become indistinct. This is the shortest arm of the Great Rift, the other, and longer, passes to the westward and embraces those long sinuous lakes typical of the Rift, such as Tanganyika and Nyassa.

The Uganda Railway crosses the Rift Valley at an angle in a north westerly and south westerly direction (see map). At the point where the railway crosses the two escarpments, the western or Mau escarpment is slightly higher (8320 feet) than the eastern or Kikuyu escarpment which is just under 8000 feet (see vertical diagram). Along the western rim of the escarpment between latitudes 0 and 1 South lies the Aberdare range which runs for a distance of 80 miles due north and south, and attains a height of 13,000 feet. The average height of the two escarpments is between 2000 and 3000 feet above the floor of the Valley, itself some 6000 to 7000 feet above sea level, where it is crossed by the railway. The drop is always steep and in some places almost precipitous. It will be seen from the diagram that the land rises rapidly from the Coast and that a comparatively short distance along the railway in the direction of Victoria Nyanza the altitude increases very considerably. The meteorological conditions along the course of the railway are very varied. Thus at Mombasa the annual rainfall is between 50 and 70 inches. For 60 miles inland in the heart of the [illegible] Station (1300 feet) the average fall is not much more than 20 inches. Again Nairobi (mile 325) lies at an altitude of 5500 feet, with an annual rainfall of 30 inches, but 25 miles further along the line the Station of Limuru lies at 7500 feet and records an average rainfall of 70 inches. The different climatic conditions at these two places as a result of altitude are remarkable and exert a marked influence upon the spread of fungous diseases. It will be shown later, under the subject of coffee, how these conditions are intimately related to the severity or otherwise of the attack of the rust fungus Hemileia vastatrix, the cause of the coffee leaf disease.

From the foregoing brief description of the salient physiographical features of East Africa, attention may be turned to those diseases and pests of plants which are of considerable economic importance. Commencing at the coast, it is proposed to discuss shortly the most important problems of the economic biologist, and to consider each plant pest in the order in which one naturally comes across them travelling in the Uganda Railway from Mombasa to the Victoria Nyanza.

A word of explanation is necessary regarding the insect pests described in this paper. It frequently happened with such a small staff that outlying districts could be visited either by the Entomologist or the Mycologist, only at rare intervals. On these occasions it was the experience of the writer that both insect pests and fungous diseases called for attention and this necessitated becoming acquainted with the entomologist's work. It was usual also for the one [illegible] to be aware of some pests of the diseases which were the [illegible] these [illegible] leading to a certain amount of [illegible] between the sections of Agricultural Entomology and [illegible]

The writer therefore wishes to acknowledge his indebtedness to the Entomological Division of the Agricultural Department of Nairobi for the knowledge acquired concerning these insect pests. ~~The following descriptions are largely the original concepts of the Entomologists, each one as far as necessary corrected~~

Detailed accounts of both Mycological and Entomological work will be found in the Annual Reports of the Agricultural

Department at Nairobi from 1908 onwards and in various pamphlets issued by the two Divisions. The Entomologist's reports are also contained in the bulletins of the Imperial Bureau of Entomology and in the Annals of Applied Biology for 1918 will be found the first record of the parasites of the asbestia bug.

II. THE COCOANUT PALM.

The rainfall along the Coastal belt amounts to between 60 and 70 inches, but towards the S.E. corner in the neighbourhood of Shimoni the rainfall is greater, and besides such indigenous palms as Hyphaene thebaica, Borassus flabelliformis and Cocos nucifera, a small patch of the oil palm Elaeis guineensis occurs. The rains are distributed in two seasons, a short one in November and a longer period extending from April to June. Along this coastal strip and reaching for about twenty miles inland coconanut palms are grown in plantations of all sizes, shapes and states of cultivation, and are owned by Swahilis, Arabs, Indians and Europeans. The palms are subject to numerous diseases and pests, the most important of which are undoubtedly the bud-rot or heart-rot, and the coconanut beetle (Oryctes monoceros). In the first, the infection can be traced from the upper external portion of the youngest folded leaf or spear, but whether primarily due to a parasitic fungus, e.g. Phytophthora palmivorum or to a Bacillus, the writer was afforded no sufficient opportunity of ascertaining. Certainly, the dried and wilted upper portion of the spear contained much mycelium, but towards the actual rotting margin no hyphae were discovered. From recent studies of this disease by Butler in India, and others

in the Phillipines and in the West Indies, it would appear that the Phytophthora is the cause of much more bud rot than is due to bacterial attacks, and it is more than likely that the East African disease is also of this nature.

Unlike other countries in which bud-rot has been recorded, the palm in East Africa is attacked at the bearing age, usually [illegible] and very considerable loss is thereby caused to owners of large plantations in which several hundreds of acres have been planted out at one time. In one case, to the north of Mombasa, an extensive plantation in which African and Ceylon nuts had been planted, 80 per cent of the young Ceylon palms were attacked and killed in three years, and so susceptible did these Imperial palms prove as the parents that the rest were taken out and [illegible] by the West Indian. The African palms appeared much more resistant, this indicating that the disease [illegible] in East Africa [illegible] native to that country [illegible] as was at one time supposed [illegible] susceptibility of imported palms and [illegible] palms, these other palms [illegible] to control this disease. One is the striking fact that palms are only found in certain places and have never been known to thrive in others. Thus in travelling along the coast South of Mombasa on the Gazi Road, the [illegible] that palms grew in patches which alternated with strips of country apparently similar in all other respects but upon which there were no palms. These palm patches are mostly cultivated, are owned by natives and alternate with areas of bush, forest or grass. The oldest natives in the district will proffer the information that their ancestors tried to grow cocoanuts on these places but invariably failed. Unfortunately for the European planter

in the Phillipines and in the West Indies, it would appear that the Phytophthora is the cause of much more bud rot than is due to bacterial attacks, and it is more than likely that the East African disease is also of this nature.

Being most destructive in which had not long been recorded, the palm in most cases is attacked at the bearing age, namely, seven years, and [illegible] to thereby cause to appear of large plantations in which several hundreds of acres have been planted out at one time. In one case, to the north of Mombasa, an extensive plantation in which African and Ceylon nuts had been planted, 60 per cent of the young Ceylon palms were attacked and killed in three years, and so successful did these impudent [illegible] as the parasite that the rest were taken out and replaced by [illegible]. The African palms appeared much more resistant, thus indicating that the disease [illegible] native to that country, [illegible] one time imported palms and [illegible] other palms [illegible] disease [illegible] in certain places and have never been known to thrive in others. Thus in travelling along the coast south of Mombasa on the Lamu Road, the writer was [illegible] palms grew in patches which alternated with strips of country apparently similar in all other respects but upon which there were no palms. These palm patches are mostly cultivated, are owned by natives, and alternate with grass or bush, forest or grass. The oldest natives in the district will proffer the information that their ancestors tried to grow cocoanuts on these places but invariably failed. Unfortunately for the European planter

it is usually only these palmless areas which can be acquired, and in a number of instances it has been found that the cocoanut will not thrive in such. A similar instance indicating that the experience gained by the natives in past generations may prove useful to the would-be planter, will be referred to under Sisal hemp.

In quite a number of instances, on the other hand, the non-success of the planter is due to a different cause, namely to land speculation. It has frequently happened with plantations of a permanent crop such as cocoanuts, coffee and citrus, that the first European holder of the land, in order to save time and expense and to ensure what he calls a quick return, has hastily ploughed and planted with immature seed or weak plants. These will grow for a longer or shorter time according to circumstances, and to the new-comer, who has just reached the country and is looking for a plantation already laid out they appear in splendid condition. The original holder sells his plantation at a handsome profit on his outlay and is heard of no more. It is usually later when the crop should be bearing that serious trouble commences and is an everlasting source of worry to the new holder. At this stage Government is generally appealed to, and such cases are some of the most difficult with which the economic biologist is confronted.

The third point which is important in any consideration of the bud-rot disease is the state of cultivation in which the plantation is kept. During the various visits of inspection paid to a certain plantation in which bud rot had been recorded since 1914, the writer was much struck on each occasion by the fact that those palms in and about the camp for native labour were not only of greater size and of more healthy

appearance than those in the plantation, but in addition bore fruit earlier (5-6 years) and never showed a sign of the disease. It was only among the palms outside of the encampment that the disease appeared. These were of the same age as they had been planted at the same season, and the only obvious difference between them was in the treatment to which they had been subjected subsequent to planting. The camp, consisting of long lines of huts and open spaces, had been kept scrupulously clean, so growth between the huts, and therefore between the palms, not allowed, and rubbish which might collect from food was never left lying about. On the other hand, but a few yards away from the camp, the ground was only weeded occasionally as the supply of labour allowed, and then only between the palms and not under-neath them. In fact, the idea seemed to prevail that pulling grass and weeds from the spaces between the palms and putting this to rot on top of the weeds growing at the foot of each tree would produce excellent tilth. [illegible] this pro-cedure gave rise to the formation [illegible] ground for all manner of fungi and insects [illegible] non-aeration of the root system [illegible] strongly [illegible] that the same methods which had been [illegible] of the native labour might prove well worth [illegible] the coconuts.

Regarding insect enemies, mention must be made of the ravages brought about by the rhinoceros beetle (Oryctes monoceros). This large beetle, nearly two inches long, flies mostly at night and feeds on the tender tissues of the youngest unfolded leaf. The edge of the leaf is not eaten away but a cylindrical hole is eaten out, the diameter of the beetle's body, from one side to the innermost soft tissues and passes through each leaflet in

them. Consequently when the leaf unfolds a circular rent appears in each leaflet, the line of holes being nearly straight. Very often the beetle manages to bore through the midrib, in which case the end of the leaf falls over and gets away. The pest can be so bad that nearly all the leaves present these lines of holes with a number of the tips fallen off. Occasionally the beetle eats his hole near enough to the one and only growing point of the palm as to be the means of starting a heart rot which in its effects upon the palm is similar to the bud rot.

Effective measures of controlling this pest were only devised after the life history of the beetle had been discovered. The female beetle lays her eggs in old rotting stumps of the cocoanut palm or other trees which happen to be in the vicinity. Hence the idea arose of making beetle egg traps and as the results have shown, these have proved fairly successful if regularly inspected. The traps are made by collecting and piling up all the old stumps and decaying vegetation and building them into ~~the form of mounds~~ pits in the plantation. The ~~mounds~~ pits are roughly two feet high and ten feet across. It is important to destroy all the rest of the rotting stumps and vegetation not used in the construction of the traps, which would be used by the beetles to lay their eggs. At regular intervals the traps are inspected, and when they are found to contain a goodly number of larvae, a covering of sand is placed over them and carbon bisulphide is injected into each, thus killing the larvae.

VII. SISAL HEMP.

Besides the cocoanut palm, sisal hemp, Agave rigida

var-sisalana, is also grown in extensive plantations along the coastal belt. This plant has borne in the past the reputation of being the only crop in East Africa which possessed no enemies. Sisal, as it is generally called, was first introduced in 1895 in the form of bulbils from Yucatan by the Germans into what was formerly known as German East Africa, and now called Tanganyika Territory.

In the extremely dry conditions of Yucatan in which sisal occurs naturally, the plant grows for twenty or more years before producing its single inflorescence (polling as it is called) after which it dies down. Owing to this slow growth but few leaves are formed each year, and hence only a few can be cut annually from each plant for the decortication of the fibre. In Yucatan it is possible to make use of the waste which is washed away by a stream of water and which contains a considerable amount of sugar. The liquid is filtered and fermented to produce a strong alcoholic drink.

In East Africa owing to the very much moister conditions the plant reaches maturity far sooner and poles and flowers at the end of three years instead of the fourth year. The leaves which are ready for cutting at this age contain very much less sugar and it was found on analysis that even in the dry season not sufficient sugar was present to render the fermentation of the waste practicable without going to the expense of concentrating the liquid first. So far, no sisal planter has seen his way to do this, and the subject has received no further attention, though without doubt both sisal waste and coffee pulp could be utilised for the production of alcohol.

In a very wet rainy season at the coast the ring-spot disease due to Colletotrichum Agaves has been recorded, and nearly always under such conditions a sun-scorch also takes

place in which large irregular patches, red in colour, are produced rendering decortication difficult or impossible. That the spores of Colletotrichum agaves can be disseminated by air currents was indicated in the laboratory by the observation that cut sisal leaves from a healthy plantation at Nairobi kept in a corner during the examination of naturally infected material, also became infected, and after some days produced the characteristic acervuli arranged in concentric circles. During the same rainy season as this disease appeared at the coastal plantations, a yellow blotch occurred in a plantation near Nairobi and by the amount of gum produced in the tissues decortication was rendered impossible. The sunken yellow areas were produced on the upper half of the leaves and varied greatly in size from a small speck to a patch several inches in length. Examination showed that the disease was due to the entrance of bacteria through the stomata. The organism a bacillus was isolated and produced the disease by inoculation but was not studied in any detail. The blotch ceased to spread on the cessation of the rains and is not likely to cause much damage except in a prolonged and abnormally heavy rainy season.

No damage as yet has been caused by insects but larger beasts such as the porcupine do, in certain parts cause considerable loss by eating off the entire tops of young plants, thus reducing the length of the leaves and consequently the fibre.

Before passing on from sisal, the case mentioned under Cocoanuts in which natives assert that some plants will not grow in certain places, may be mentioned. The manager of a certain sisal plantation came to the conclusion that his plants were, for their age, not nearly so tall as those of a neighbour, and furthermore, the plants commenced pulling at about

3 to 3½ years instead of 4. The stunted growth was not confined to the sisal, for a plantation of young trees, to be used in future as fuel, also failed to thrive, and although very few actually died, the others were obviously making very slow growth. The native labourers engaged on the plantation were asked, when the first [illegible] observations were made, to bring their slave and families from their reserves to live with them on the plantation as there was plenty of room in between the plants of the younger blocks of sisal in which to grow mealies and beans. The natives reply was to the effect that it would be useless to bring their families there because they knew that mealies and beans would not grow in such a place. Experiments [illegible] of maize grown close to the sisal confirmed the natives' views on the subject, as few plants succeeded in getting ears. An explanation of this case was forthcoming on subsequent investigation, when it was discovered that the soil [illegible] light loam to a decided clay, was very shallow and had been deeply ploughed, and that this had exposed the very acid sub-soil. It has not been established as a fact, but the natives knew that maize would not thrive. They were unable to give any reason but merely made the assertion.

IV. COFFEE.

The growing of coffee is one of the staple industries of the highlands of East Africa, and has steadily increased since Coffea arabica was first planted by various missions a quarter of a century ago. Of native coffee only one occurs in the country, namely, C. mandiensis, which is found on the steep banks of rivers at an altitude of over 7000 feet and is a shade loving plant. C. robusta is the native coffee of

Uganda. It is to be noted that there is no resting period such as, for instance, occurs in Rhodesia, where once every year all the leaves fall from the tree. In East Africa coffee is not deciduous, but is continually producing more leaves, rapidly during the rains, much more slowly in the dry season. Both C. arabica and C. liberica are subject to a number of fungous and insect enemies. Meteorological conditions play a most important part in the severity of attack of both fungi and insects, particularly so in the coffee leaf disease due to the rust Hemileia vastatrix B. & Br.

So far as the writer is aware, the history of coffee cultivation in the eastern hemisphere, including Africa, has always been intimately connected with that of Hemileia, and has usually resulted in the ascendancy of the parasite sooner or later. This does not necessarily mean that the coffee trees are threatened with destruction as was the case in Ceylon, but it does mean that Hemileia is slowly spreading in all those countries in which coffee is grown, with the present exception of the high lands of East Africa.

The history of coffee growing and Hemileia in the country are important from this point of view, and it is hoped to deal with the subject of coffee leaf disease in Central and Eastern Africa in more detail in a further paper. For the present purpose, some observations of the disease as it is now found in the highlands of Kenya Colony will suffice.

The first observation of importance is that both those in Africa and in Ceylon have the teleutospores of the parasite been found. It is a curious and as yet an unexplained fact that since Marshall Ward worked out the life history of the fungus in Ceylon, and a German observer reported the presence of

teleutosporos on some African specimens of the disease not long afterwards, these sporos have never been observed since. In this connection it will be remembered that it was the germination of the teleutosporos which furnished Ward with the clue to the nature of the fungus. The likelihood therefore of the artificial [illegible] plant to get very [illegible] gated in the countries in which it is found by the teleutosporos only.

The second observation to be recorded is, that the first attack of Hemileia is undoubtedly the most severe to be experienced, subsequent attacks other things being equal, are less marked in intensity. Nearly all the trees are badly infected, but in well-kept plantations only a small percentage of the leaves actually fall, although the lives of the others are considerably curtailed. Severe defoliation never takes place and subsequent attacks are less severe, that is to say, not so many portions of [illegible] leaves are infected. [illegible] an ill kept plantation is compared with others better cared for in the vicinity at any season of the year. The initial preparation of the ground, the proper planting of the seedlings, pruning and the amount of exercise the trees are allowed to carry, are all factors which influence the resistance of the host.

The third and perhaps most important observation is the effect of altitude and, therefore, of temperature both on the tree and on Hemileia. At the Mission station of Mura near the Coast at an altitude of nearly 2000 feet, the annual

rainfall is about 50 inches and the temperature is round about 75°F.-80°F. both day and night. The atmosphere is therefore warm and moist, conditions favourable to the luxuriant growth of coffee but much more so to Hemileia vastatrix which has destroyed the coffee plantation attached to the Mission. In the neighbourhood of Nairobi the general altitude of the plantations lies between 5000 feet and 6000 feet, and the rainfall of the district amounts to an average of 30 inches. The atmosphere is therefore dry, although it is to be noted that very heavy dews are precipitated at night, and it is in this way that the uredospores usually germinate. The temperature is never very high, and rarely exceeds 75°F., dropping again at night to the region of 60°F.-50°F. and sometimes lower. The atmospheric conditions are warm but not moist and the general balance of conditions is less favourable to the spread of Hemileia than to the growth of coffee. Ten miles to the south West of Nairobi in the Limuru district very different conditions prevail. The altitude is greater, between 6000 and 8000 feet and hence colder on the whole. On the other hand the rainfall is much greater, and on an average lies between 60 and 70 inches. The atmosphere is saturated in the mornings and a Scotch mist is the normal experience. The climatic conditions at Limuru, therefore, are the reverse of those ten miles away, and a moist but comparatively colder atmosphere prevails. Coffee under these conditions is not so luxuriant in growth, is slower but more hardy. Hemileia is prevalent throughout the district but is scarce, the first attack is the worst as is the case at lower altitudes, but it is nothing like as severe, and in well kept plantations is a normal crop. The disease must be searched for.

The conditions then which prevail at altitudes of 6000 to 7000 feet are still favourable to coffee but very much less so to Hemileia and the limiting factor to the rapid spread of the disease is temperature. At such altitudes the temperature is too low for the parasite to flourish.

It has been pointed out that subsequent attacks of the rust are less severe than the first, which means that the coffee trees acquire a certain power of resistance, or become less susceptible after the initial attack. That this partial immunity is not due to a lessening of the virulence of the parasite is demonstrated by the fact that a hitherto unattacked plantation in the vicinity of others which have been already visited, is much more severely infected when Hemileia is present on all at the same time. The virulence of the fungus remains the same, the resistance of the host increases, ~~or diminishes as the case may be.~~

Under such conditions, spraying for leaf disease has proved successful at altitudes of 6000 to 7000 feet. Any dilute fungicide has been found by experiment not only to control the disease but if applied at the right time, to completely eradicate it from plantations. The usual time for spraying is just before the long rains commence, and again at their termination. Reinfection usually takes place in subsequent seasons by reason of wind blown uredospores from a plantation which has not been sprayed. In the Limuru district quoted above, the disease does such little damage that spraying, always an expensive business, has not been resorted to. The most popular fungicide, and one easily made up, is known locally as "carbide", and is prepared by adding 1? ozs. of calcium carbide to 4 gallons of a solution containing 2 lbs. of copper sulphate in water. At lower altitudes;

e.g. between 4000 and 5000 feet, spraying with such dilute fungicides is of no avail, but with a stronger mixture containing 4 lbs of copper sulphate and 24 ozs. of calcium carbide per 40 gallons, the results are much more encouraging, particularly on well cultivated plantations. In fact, at such altitudes it [illegible] spray regularly to keep Hemileia in check. Below 4000 feet, if the rainfall is at all suitable for the growing of coffee the other factor of temperature is so much more favourable to the rapid spread of Hemileia that the disease cannot be controlled by any known method, and on account of this coffee growing is rendered unprofitable at such altitudes.

Of other fungous diseases of coffee, mention may be made of the leaf and berry spot due to the attacks of Cercospora coffeicola Berk. [illegible] this fungus has been caused on neglected plantations, and cases have occurred in which [illegible] resulted. On the berries it is rather more [illegible] a point of view, as the affected fruits [illegible] This trouble is more prevalent during [illegible] but can always be found on [illegible] the leaves at any time, or [illegible] to turn red. The disease is easily controlled by spraying either with the "carbide" mixture mentioned above, or with Bordeaux mixture containing 2 lbs. of copper sulphate per 40 gallons.

Quite recently a berry spot has occurred due to the infection of a species of Colletoria, and in its effects on the fruit is similar to that produced by Cercospora coffeicola. The fungus has not been studied in any detail and whether this species is identical with S. [illegible] recorded on coffee berries from Central America, further work must determine. The disease is more common on low lying heavy soil, and is quite

liable to cause considerable damage unless checked by spraying when the berries are still green.

Rot of the roots is not very common, and wherever it occurs usually indicates that the ground has not been properly prepared at the start, and that stumps and roots of native trees have been left in the soil. These are always sources of infection of root-destroying fungi, the mycelium of which spreads from the decaying stumps through the soil on to the roots of the coffee trees.

Dieback of the branches is troublesome in certain parts of the country, particularly where the rainfall is more than 45 inches and the soil is heavy. Up to the present this trouble is not fully understood, but among various contributory causes rendering the trees liable to this disease are unhealthy conditions of cultivation, water-logged soil, attacks of Hemileia, overbearing, insufficient pruning and the presence of Colletotrichum coffeanum.

Dieback is far more prevalent in Uganda where the general conditions are not so favourable to coffee as they are in the highlands of East Africa, and the trouble has received a good deal of attention at the hands of the Uganda Agricultural Department which has recently issued a comprehensive pamphlet on Dieback written by the Government Botanist, W. Small.

A very singular dieback of the main stem has occurred more than once in nearly every coffee district and has so far baffled any attempts to elucidate its true cause. Nearly every case of the disease was reported shortly after a heavy thunder storm had passed over the plantations, and was at first ascribed to lightning. Circular patches of trees from 20 to 50 in number were discovered with shrivelled and blackened foliage; and there was always one tree in the centre which was more affected

than the rest. The least affected were on the outside and intermediate stages occurred between.

The shoots bearing the blackened leaves were dead towards the tips and for some distance down each shoot, including the main stem, the cortex was discoloured and the cambium [illegible]. Unless the affected parts were cut off well below the discolouration in the cortex the trees invariably died slowly back to the roots.

On old specimens which had thus died, the cambium had been replaced by a brown mycelium and very often the fructifications of a Diplodia were found on the bark, and always the pycnidia of a Phoma and a Phomopsis. At one time it was considered that this particular form of dieback was due in the first place to the Phoma or to the Phomopsis, but the few inoculation experiments which could be carried out did not lend support to this view.

The problem is an interesting one of some economic importance and calls for a more thorough investigation than has hitherto been possible into the relations existing between the [illegible] climatic conditions, the suddenness of the withering, the rapid disorganising of the cortical tissues and the presence of the three parasitic fungi mentioned above.

The insect pests of Coffee are more serious than are the parasitic fungi, and mention may be made of at least two which have been computed to cause more annual loss than perhaps any other disease to which coffee is subject. The variegated bug, Antestia lineaticollis (Stal.) has been known almost from the commencement of coffee planting throughout Africa. This insect, which resembles a lady-bird beetle in size and general appearance, but which is a true bug (Homopteron), yellow, gray

and black in colour, punctures all the young growing parts of the tree, but chiefly the very young flower buds which are formed in whorls in the axils of the leaves. The result is a non-formation of flowers and a proliferation of shoots in their place, thus bringing about an almost total failure to set fruit and causing much additional labour and expense in pruning. Antestia also pierces and sucks the green berries producing a stain upon the kernels which considerably lessens their market value. As is usual with such insects, spraying either with a stomach poison or a contact insecticide, is of no avail. The bug is active and either hides under leaves and crevices, or flies to the ground where it becomes invisible owing to its colour. In the past the usual method of combatting this pest was the collecting by hand of the young and mature bugs. Recent knowledge of the life history, however, has indicated a more effective way of controlling the numbers of the insect. The eggs are laid in clusters of a dozen on the underside of the leaves and are normally pearly white in colour. Careful observation showed that a large number of eggs are not white but grey, and that out of these grey eggs hatch out, not young Antestia bugs but minute chalcids. Two species of these small insects have been discovered which thus parasitise the eggs of Antestia, and it has been found possible on the Government Experimental Farm near Embu to breed the parasites in the laboratory in such numbers as to completely check the increase of Antestia. It is hoped in time to be able to distribute this parasite early enough to those plantations which show signs of the pest to prevent the insect from doing appreciable harm.

Another serious insect pest is comparatively new, having first made its appearance in 1918, and is a species of thrips, or more correctly Diathrothrips (D. coffeae, Hall). This minute insect appeared

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in the dry season of 1915 in clouds, and settling upon the coffee trees of a plantation close to Nairobi, sucked every green part almost dry, producing a conspicuous silvery appearance of the foliage. The trees were entirely defoliated, and in some instances killed. From the Nairobi area the pest gradually spread in a north easterly direction and is approaching Uganda. [illegible] is of the [illegible] least avail, for at the first contact of an insecticide the great majority of insects fly into the air and hover over the trees in a cloud. They cannot, however, stand heavy rains, and shortly after these commence the pest disappears. The insect appears in very large numbers only in a prolonged dry season and then reigns supreme until the next rains clear it off again. Where it originally came from, its life-history, and what becomes of it during the rains are problems still awaiting solution.

A [illegible] pest which is often responsible for a large [illegible] is the [illegible] of various species of [illegible] in the [illegible]. Newly planted [illegible] seedlings are very subject to attack and are girdled just below ground level. Gathering by hand, and the protection of the young stem by a band of some durable substance soaked in grease, are the methods employed in controlling this pest. Baits of chopped grass sprinkled with Paris Green have not proved very effective.

The remarks relating to the sound cultivation of the coconut palm are equally applicable to coffee and indeed to any permanent crop. They may be briefly summarised here and refer more particularly to coffee.

(1) If the land selected is forest or bush, it is most important to stump up completely all roots, otherwise root rots will make their appearance sooner or later.

(2). The proper preparation of the soil by thorough ploughing is another essential which cannot be repeated when once the trees have been planted. Some of the best results have been obtained by first breaking the land and then leaving it to lie idle for the next six months, after which it is either ploughed back again or cross ploughed. The land should not be planted until a year has elapsed from breaking.

(3) Only suitable seedlings must be selected, and these must be planted with care so as not to bend up their tap roots.

(4) The young trees should be topped at regular intervals.

(5) Pruning and "handling" are most important. By "handling" is meant the removal by hand of all young shoots which grow less than one hand's breadth apart on all branches.

(6) Great benefit results from spraying as a precautionary measure for Hemileia, Cercospora, Colletotrichum, Septoria, etc.

Finally, as regards Coffee, it is a point of considerable interest to compare the yield of the East African crop with that of other countries of the East. In the best days of Ceylon coffee the maximum yield was not more than [illegible] ton to the acre, and the average was rather below this. In Uganda the writer is under the impression that it is about the same, but in East Africa the average yield is greater; over a ton has been recorded more than once, and [illegible] ton to the acre is not considered an excessively heavy crop. Latterly, however, it has been found by experience that the trees do better, are not so exhausted and are therefore more capable of withstanding disease, if the crop is limited to not more than [illegible] ton to the acre. This can be done by stripping off some of the young fruits soon after they have set.

V. THE FORESTS OF THE HIGHLANDS.

The forest areas of East Africa are not very numerous but are of considerable extent, the most important from the point of view of valuable timber being those of the Highlands at altitudes ranging from 6000 to 8000 feet. Mention may be made of the areas round the bases of Kenya and Elgon, the Aberdare Mountains and the highest points of the escarpment of the Great Rift Valley known as the Mau and Elgeyo forests on the western edge, the Laikipia and Kikuyu on the Eastern side. Of the many different trees which yield good timber only a few are used at present to any great extent. The yellow wood, Podocarpus gracilior, and the so-called East African Cedar, Juniperus procera, are used extensively in building. The m'hugu, Brachylaena Hutchinsii, a giant member of the Compositae, is largely used for fuel, and for fencing and telegraph poles by reason of the fact that white ants do not attack its wood.

Podocarpus, so far, has no fungous enemies, its timber however, is very much attacked by termites. Juniperus procera is subject to the attacks of the bracket fungus Fomes juniperinus, which causes very great damage by producing a heart rot. About 70% of the trees are attacked, and it is quite common to see newly felled trunks with a large part of the centres replaced by spongy red masses extending for considerable distances.

Fomes juniperinus is almost certainly a wound parasite, the hoof-like fructifications of which are nearly always formed just below a small branch which has been broken off a long time previously and which has not been occluded over. The heart wood of Juniperus procera is resistant to the attack of white ants.

Brachylaena Hutchinsii, a tall tree with a straight trunk, is often killed by strangulation brought about by the entwining and encircling branches of a species of fig. This fig gradually surrounds the trunk of its host and all stages are commonly met with, from the partially grown fig at the base of the stem to the nearly fully matured parasite with its rounded head of foliage, each of which can just be distinguished the topmost branches of the Brachylaena, evidently in extremis. Finally a stage is reached in which the Brachylaena has disappeared and rotted away leaving the fig by itself. The latter's victory, however, is not of long duration, for soon after the disappearance of its host the fig itself dies.

Recently, an important Sclerotinia disease of the young seedlings of Brachylaena in the nurseries of the Forestry Department near Salroti has been recorded and partially investigated. The young trees were found to wither and die when they had reached a height of from 3 to 4 feet. An examination of the roots brought to light numerous small black sclerotia, irregular in shape, clinging to the base of the stem just below ground level. The sclerotia varied in size from an ordinary pinse head to a flat irregularly shaped mass the size of a threepenny piece. Several specimens of the sclerotia were collected and kept under conditions as natural as possible, and after a few months began to produce apothecia on long ($\frac{1}{2}$") stalks. None, however, succeeded in reaching maturity, and when nearly fully opened, withered and died down. On investigation these nearly ripe apothecia were discovered to be infested by species of eelworm, and the question arises as to whether or not in nature the spread of this fungus is kept in check by the eelworm. The investigation could not be completed and the few apothecia produced in the places where the infected trees

Brachylaena Hutchinsii, a tall tree with a straight trunk, is often killed by strangulation brought about by the entwining and anastomosing branches of a species of fig. This fig gradually surrounds the trunk of its host and all stages are commonly met with, from the partially grown fig at the base of the stem to the nearly fully matured parasite with its compact head of foliage, out of which can just be distinguished the topmost branches of the Brachylaena, evidently in extremis until the final stage is reached in which the m'hugu has disappeared and rotted away leaving the fig by itself. The latter's victory, however, is not of long duration, for soon after the disappearance of the host the fig itself dies.

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had been removed, likewise succumbed to coiwerm attack.

VI. CITRUS.

The lime is found wild along the coast, and was almost certainly introduced from the East by the early Portuguese explorers and settlers. The excellent greenish orange of Zanzibar, on the other hand, was probably planted by the early Arab traders.

At the present time, all varieties of citrus are grown, generally from budded stocks imported mostly from South Africa, and at one time it was thought possible to export the fruit to England. Oranges, lemons, grape-fruit, etc. might be placed on the English market at a time when no other citrus fruits were available. Partly because of heavy sea freights via the Cape, and still more heavy Suez Canal dues, and also because the comparatively young plantations of the Highlands are still producing very thick-skinned and not very juicy fruits, the attempt has not yet been made. In these plantations which have been raised from seed, [illegible] but take longer to reach their prime, namely, eight years as against three years from budded stocks. Very much better fruit is produced at lower elevations such as 3000 to 4000 feet. A few factories have been started for the extraction of citric acid, and it is expected that this will prove a profitable industry.

Perhaps the most serious disease, if not the most common, is the foot-rot or mal-di-gomo, generally ascribed to the attack of Fusarium limonis, but which the writer is of opinion is more likely to be due to bacteria in the first place. The Fusarium which is certainly present is probably secondary and gains entrance through the cracks of the bark brought about by the activity of the bacteria.

Various bacterial leaf spots, but not the Citrus Canker of the Gulf States and South Africa, are common and usually make their appearance in the dry season causing considerable damage by defoliation. This is particularly the case in a neglected grove or one in an unsuitable situation as a stiff soil apt to be water-logged in the rains. The most common form which the spot disease takes is large concentric rings of small blisters, hard in texture and brown in colour.

The remarks as to good planting and cultivation in the cases of cocoabuts and coffee are also applicable to citrus.

As regards insect pests, citrus in East Africa is an outstanding example of the introduction of pests into a country on the imported hosts. Both the Australian bug, or fluted scale, Icerya purchasi, and the California red Scale - Aspidiotus aurentii, have been introduced in this manner. Considerable loss has been caused by both, but more particularly by the former, which does not confine itself to citrus and will infest almost all other woody plants, as for instance coffee, roses, black wattle (Acacia).

No insecticide has yet been devised which will control this scale effectively. Fortunately, however, there is an African lady bird beetle, the larva of which will devour the Icerya and helps to check to some extent the damage caused by this insect. ~~This is particularly the case of small trees which can also be hand pinked.~~ A resin soda spray has been employed with good results against the Aspidiotus, but it is now the endeavour of the Government to destroy all trees infected by the red scale and to replace them with healthy young stock.

VII. WHEAT.

Wheat-like coffee affords another instance of the variable relations existing between host and parasite under different climatic conditions. For the purpose of the present paper it will prove useful to contrast the relation of the rust fungi to wheat in these widely separated countries such as England, East Africa and Australia. In all three countries the same three rusts attack wheat, namely, the black stem rust, Puccinia graminis, Pers. the yellow rust, Puccinia glumarum, Erikss. & Henn. and the brown or leaf rust, Puccinia tritici, Erikss. In England Puccinia glumarum is the commonest and most destructive; in Australia Puccinia tritici causes most damage because of its very early appearance in the season. The writer has been informed that when wheat is only a few inches high in New South Wales Puccinia tritici commences its attack. In East Africa the greatest destruction is due to Puccinia graminis, while in addition to this, Puccinia glumarum is very common on certain wheats of Egyptian origin. These two rusts usually, and Puccinia tritici nearly always, appear late in the season, generally after the wheat has come into flower. Hence it will be seen that the problem of controlling rust in wheat in East Africa differs from that in the other two countries mentioned. Climatic conditions also influence very considerably not only the growing of the wheat but also the spread of the rust Thus at Nairobi there are two rainy seasons in the year, during both of which it is possible to grow early maturing varieties of wheat. The fact that it is necessary to employ varieties which mature early, that is, in four to five months, because of the shortness of the seasons, makes it possible to grow with success such varieties which escape the rust attack on account of this character. As an instance of this, the Australian

wheat "Florence" may be cited, which at Nairobi was found to mature in 4 months after sowing. "Florence" is not a rust resistant variety, but when sown early enough escapes the rust attack which usually appears late. This was clearly demonstrated at the Experimental Farm near Nairobi where during some of the trials "Florence" and another Australian wheat "Bobs" were sown in adjacent plots and at the same time. "Bobs" takes between six and seven months to ripen and always falls a victim to the attacks of Puccinia triticina and Puccinia graminis which makes their appearance generally in the third month after sowing, so that for the last three months of growth "Bobs" has these two rusts to contend with. On the other hand "Florence" is nearly ready to be reaped when the rust commences and has reached a stage when the presence of rust can do but little or no damage. Had "Florence" been sown two months after "Bobs" so as to be ripe at the same time as the latter it would have been attacked and badly damaged.

Another condition which plays an important part in the severity of the attack is the amount of nitrogen in the soil. In England wheat, being an exhaustive crop, is usually grown on heavy land, that is, on land likely to contain a sufficient quantity of nitrogen for the growth of the plant. In East Africa the great majority of soils contain a larger proportion of nitrogen than in England, and it has been shown by experiment that an excess of nitrogen renders wheat more susceptible to the attacks of rust. A very striking demonstration of this fact was provided unintentionally in a certain large field of wheat grown in the Highlands (Njoro) of East Africa. At a distance of a few hundred yards the wheat appeared brown in colour with the exception of a small triangular patch in one corner which was green. On closer examination the brown

colour was found to be due to numerous pustules of Puccinia graminis and Puccinia triticina, while the green patch was nearly free from rust. The wheat was the variety known as Kieti and had been sown all at the same time, but on the triangular patch flax had been grown the previous season. Following this observation, repeated trials were made at Kairobi with a susceptible wheat such as "Bobs", one block of which was sown on land which had borne a root crop the season before, and another block of "Bobs" on land which had previously carried flax. The difference in the rust attack was striking. The wheat on the old flax land was rusted to a far less extent than that on land which had not borne flax. The explanation offered is that flax, itself a very exhaustive crop, removes from the soil that amount of nitrogen which would otherwise render the wheat very susceptible to the attack of rust. That this explanation is probably correct is borne out by the fact that wheat grown upon land which has previously carried beans is so easily affected by rust that in most cases the crop is almost destroyed. In this case the already high nitrogen content of the soil has been augmented by the activity of the nodule forming bacteria of the beans. It has been found that the following rotation of crops is an excellent one and produces satisfactory results - (1) Flax, (2) Wheat, (3) Beans, (4) Flax or maize.

The attempt to breed rust-resisting hybrids of wheat on Mendelian lines has met with a considerable measure of success, some of the selections so produced possessing such desirable characters as early maturity, good milling grain and "strong" flour. Two of these varieties may be mentioned here, one known as Cross No.11 is a selection from the hybrid "Early Kieti and "Red Fife" and has proved highly resistant to Puccinia

graminis in all parts of the country so far tried. The other resulted from the cross "Egyptian No.5" and "Nut Cut." "Egyptian No.2" by itself was found to be very resistant to *Puccinia graminis* but susceptible to *Puccinia glumarum*, while the Australian "Nut Cut" possessed the opposite characters and was susceptible to *Puccinia graminis* but resistant to *Puccinia glumarum*. From the resulting hybrids this particular culture known as Cross No.15 was selected and [illegible] a striking example of Mendel's law of inheritance in that it was highly resistant to both rusts.

VIII. **FLAX.**

Flax which grows well in the Highlands is subject to the attacks of numerous enemies, chief of which at the present time is the cut worm, the larva of certain moths (*Euxoa* etc. - see under Coffee). The loss caused by the depredations of this grub are enormous, whole fields being completely destroyed soon after the plants appear above the ground. Some idea of the conditions [illegible] in which this insect occurs may be gained from the experience of the [illegible] district where on one occasion during an attack of cut worm, the flax instructor set himself to count in a given area the number of grubs in the soil. By sitting on the ground and going over the surface soil with his hands and without moving away from his position, he gathered no less than 170 larvae! It will be understood from this what an extremely difficult problem is before the prospective flax grower. Any spray which poisoned the cut worms also killed the flax, and up to the present no method has been devised of coping with this most destructive pest. Flax is not the only plant attacked. As pointed out above, newly planted coffee is very subject to the attentions of these countless larvae, but in some districts the pest is more prevalent than in others.

The mature flax plant is often attacked by the flax moth ~~of~~ which lays its eggs in the ripening capsules so that considerable damage is caused in this way to flax grown for seed.

Of fungous diseases, the wilt caused by Fusarium lini is the most important and is commencing to spread in certain localities. The appearance of this disease is most probably due to imported seed bearing the conidia of the Fusarium, and its spread is undoubtedly due to the present practice of growing two or even three crops on the same land without a break or rotation.

The best means of controlling this disease, other than the endeavour to find a wilt-resisting variety, must be either the practice of a thorough rotation of crops, or the following of the land for a season or more.

Some experiments designed to prevent the spread of the wilt by infected seed have been commenced, and although of a preliminary nature, have given rise to some unexpected results. As flax seed is extremely difficult to disinfect by the usual method of soaking with formalin solution, or with copper sulphate, by reason of its mucilaginous coat, it was thought possible that the desired result might be obtained by subjecting the seed to the action of formalin vapour. The object to be aimed at was the killing of any adhering conidia of Fusarium but at the same time not injuring the seed, and this was carried out in much the same way as a sick room is disinfected by formalin. Both formaldehyde tablets and commercial formalin were used and gasified, the former in the usual apparatus, and the latter in a porcelain dish heated over a small lamp flame. The first experiments were designed to find out what effect the action of the gas would have on the germinating power of the

seed. Fresh seed from an uninfected area was placed in a crystallising dish on a stool on which was also the gasifying apparatus in a small air-tight room, and the gas was allowed to act for four hours. The amount of formalin or the number of tablets was to be increased steadily until a marked effect on the germination of the seed was produced. After each experiment 200 seeds were counted out and placed in petri dishes to germinate. The first two or three times this was done no effect either on the rate or on the amount of germination was apparent, the results showing 98% germination in two days (48 hours). Latterly, however, with a greater concentration of gas, it was found that the rate of germination was accelerated, that in fact 98% germination was obtained in one day (24 hours).

This result was quite unlooked for, and is the reverse of what would be expected. For the usual result of soaking seed, for instance coffee, in a solution of formalin (over night in a 0.3% solution) is to retard its germination from one month to anything up to three months according to the age of the seed. The effect of the gas on the Fusarium conidia was not tried owing to the absence of infected material at the time this work was started, and it is unfortunate that it was not possible to finish these very interesting experiments. Should they be repeated with a view to finding out what concentration of formalin vapour should be used and for how long it should act upon flax seed bearing conidia without injuring the former but killing the latter, a simple method is at hand for the disinfection of seed. Such a method could be carried out easily by the grower himself in any small store which could be rendered gas tight.

IX. INSPECTION OF IMPORTED PLANTS.

In conclusion, some observations may be given with

reference to plant import inspection, which has for its object the keeping out of the country of certain foreign diseases and pests. The writer is aware that the practice of the United States and of the Union of South Africa is to place the responsibility of this important branch of pathology under an entomological officer. Apart from experience gained in East Africa (Mombasa) the opinion is here emphasized that it would be wiser to follow the example of Germany - the one country which has studied diseases of plants to a greater extent than any other - and to have such inspection performed under the authority of a pathologist.

It is submitted that it is more difficult to diagnose diseases such as citrus canker, apple canker and all such as affect stocks, and in addition those which are likely to be borne as spores adhering to seeds such as the spores of flax wilt or flax rust, than to recognise insect pests, chiefly scale insects, which are likely to be introduced. In other words, it is easier for a pathologist to recognise insect pests than it is for an Entomologist to diagnose fungous and bacterial infections.

So far as East Africa is concerned, with the exception of the Australian bug and the California red scale, few other insect pests have been allowed to enter the country, and these could have been avoided with proper care. On the other hand a very large number of fungous diseases have been already introduced either as perennating mycelium in the tissues or as infected seed.

A number of cases are on record in which the Plant Import Inspector, (under the Entomological Division) has been obliged from want of knowledge to refer plants to the Plant Pathologist, and in most of these a certain number of plants

were found to be infected by some disease or other and had to be refused entry.

A notable and instructive example may be cited. A large number of apple stocks were imported from abroad, and were provided with a certificate by the Entomological Division of the Department of Agriculture as having been inspected by that Division's Officials and passed as free from all disease and therefore fit for export. The Plant Import Inspector at Mombasa, after fumigating them against possible insect pests, passed them on to the Mycologist. On arrival at Nairobi examination showed that many of the stocks bore small but recognisable lesions of the apple canker parasite, Neetria ditissima, and were accordingly destroyed, as this particular disease was hitherto unknown in the Country. Why, may one ask, should the certificate of freedom from fungous disease be made out by an entomologist ?].

Illustrations in text:-

(1) Map of Kenya Colony showing altitudes.

(2) Vertical diagram of Uganda Railway.

W. J. Dowson.

Kew Kenya

28747/21

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21 June 1921

Sir,

I am to ack. the rect. of your letter of the 9th of June, and to thank you for your offer to publish in the Kew Bulletin Mr. J. Dawson's paper entitled "Some account of the problems of economic biology in East Africa (Kenya Colony)".

2. If Mr. Dawson, who is being consulted, has no objection, the S. of S. will be glad to avail himself of your offer

DRAFT.

Director,
R. Botanic Gardens,
Kew

MINUTE.

Mr. [illegible] 20.6.21
Mr. [illegible] 21
Mr.
Mr. Green.
Sir H. Read.
Sir G. Fiddes.
Col. Amery.
Mr. Churchill.

2 drafts

New Kenya

28747/21

215

Sir

[illegible] January 1921

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2. I am to enquire whether you have any objection to this proposal. ~~The Director states~~

DRAFT.

Dowson Esq

M.A. [illegible]

MINUTE.

Mr. Jewell 20 Jan 21
Mr. Parkinson [illegible]
Mr.
Mr. [illegible]
Sir H. [illegible]
Sir H. [illegible]
Sir G. [illegible]
Col. Amery.
Mr. Churchill.

2 drafts

[illegible] glad to be supplied with copies of the maps and diagrams referred to by for reproduction in the Bulletin